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16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 6273 - 7327.

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Abstracts 6273 - 7327

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**U. S. Department of Health, Education, and Welfare**
**Public Health Service**
**Environmental Health Service**

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6273 APTIC NUMBER 16494

Akamatsu, Isao, Hiroshi Kanishima, and Yutaka Kimura
DEODORIZATION OF EXHAUST GAS IN KRAFT PULPING. (PART I). ON THE FORMATION OF MALODOROUS COMPONENTS IN KRAFT PULPING. (Kurafuto-parupu seizo kotei haishutsu gasu no mushuka (1 ho): Jokai-chu ni okeru akushu-seibun no seisei ni tsuite). Text in Japanese. Kami-pa Gikyoshi (J. Japan Tech. Assoc. Pulp Paper Ind.), 22(8): 406-410, Aug. 1968. 3 refs.

The formation of malodorous substances, methy mercaptan (MMA) and dimethyl sulfide (DMS), in the process of kraft pulping was studied in two types of Japanese pulp woods: softwoods (red pine, cedar and Japanese cypress) and hardwoods (beech, poplar, cherry and pasania oak). Alkaline (Na2O) and sodium sulfide (NaS) were added to a 400 g dried pulpwood block in an electric autoclave and boiled for 5-1/2 hours at 185 C. Then 5 cc of exhaust gas (raw blow gas) was sent into the cyclone-separator (a cylinder with the diameter of 3 cm and the length of 18 cm) and analyzed for malodorous substances (MMA and DMS) by the use of Yanagimoto GCG-5DH type gas chromatograph. Larger amounts of MMA and DMS, especially MMA, were produced by pulping hardwoods than by pulping softwoods. In pulping the same wood type, the amount of malodorous substances was increased with the increase of cooking hour and temperature, and the concentration of NaS. The white lauan produced the same malodorous substances in quality and quantity as obtained in the pulping of Japanese hardwoods. When the pulping was performed by a batch system, the concentration of DMS was decreased to trace with the depression of pressure in the autoclave.

6274 APTIC NUMBER 16710

POLLUTIONLESS REFUSE INCINERATION. Brit. Chem. Eng., 13(12):1653, Dec. 1968.

A continuous closed system, achieving complete combustion of refuse without atmospheric pollution, is described. In this system, a unique grate design ensures efficient transport of the burning refuse and creates maximum disturbance and aeration of the furnace bed. Operation is automatic, with minimum labor requirements, and unit capacities vary from 60 to more than 900 t/d.

6275 APTIC NUMBER 15996

Campbell, Frank Leslie and Willis Conrad
INSECTICIDE COMPOUND AND METHOD OF DISPENSING AN INSECTICIDE. (Assignee not given.) U. S. Pat. 2,381,257. 2p., Aug. 7, 1945. (Appl. July 24, 1941, 3 claims).

The invention provides an insecticide in a liquid or solid form which decomposes at atmospheric pressure and room temperature, to release a toxic gas for the destruction of insects. The method consists of exposing insects to a compound of sulfur dioxide and acetone which decomposes to release sulfur dioxide and acetone vapors in a toxic volume. Other compounds for use as insecticides include SO2 and ethylene oxide, SO2 and dioxan, SO2 and trimethylamine, SO2 and triethylamine, and SO2 and dimethylaniline. The invention makes it possible to pack and ship sulfur dioxide in a readily usable form.

6276 APTIC NUMBER 16212

DeCarlo, Joseph A., Eugene T. Sheridan, and Zane E. Murphy
SULFUR CONTENT OF UNITED STATES COALS. Bureau of Mines, Information Circ., no. 8312, 44p., 1966.

The coal reserves of the United States occur in thousands of different seams that have widely varying sulfur contents. Both high and low-sulfur coals are mined, with the production of coals of various sulfur contents depending chiefly upon their end use. Nearly two-thirds of the total coal remaining reserve is low-sulfur coal. Roughly, three-fourths is sub-bituminous and lignite (low rank) and the balance is bituminous and anthracite. The sulfur content of bituminous coals varies considerably. Approximately 166 million tons of the total bituminous coal was low-sulfur coal. Approximately the same proportion of the total produced could be considered medium-sulfur coal, while the remaining balance of about 28 percent had a high-sulfur content. Anthracite generally contains less than 1 percent sulfur. Sub-bituminous and lignite, also are generally low in sulfur. Approximately 47% of the bituminous-coal output is burned by electric utilities. Coals so consumed generally may be classified as medium-sulfur coals, as the average sulfur content of shipments to utilities in 1964 averaged about 2.3%. The coking industry probably has the most stringent sulfur requirements of any of the major consumer groups because of the effect of the chemical constituents of the raw materials on end products. The average sulfur content of coals carbonized is about 1%. In order to utilize some coals which contain more than 1% sulfur, the coke industry does considerable blending of medium- and low-sulfur coals. Sulfur content of the coals currently used for other industrial purposes and space heating in homes, business establishments, schools and Government buildings probably falls between that used by electric utilities and coke plants. A survey of coal used by Government buildings for the year 1964 showed an average sulfur content of 1.1%. The sulfur content of exported coals is low, since the bulk of the exports are metallurgical or special-purpose coals and contain 0.7% or less sulfur. (Author summary modified)

6277 APTIC NUMBER 16352

Del Vecchio, V., P. Valori, C. Melchiorri, and A. Grella
AROMATIC POLYCYCLIC HYDROCARBONS FOUND IN THE EXHAUST GASES OF ENGINES RUN ON GASOLINE AND LIQUEFIED PETROLEUM GAS. (Idrocarburi policiclici aromatici nei gas di scarico di motori alimentati a benzina e a gas liquido). Text in Italian. Nuovi Ann. Igiene Microbiol (Rome), 20(2):174-190, March-April 1969. 33 refs. (Presented at the Symposium on the Chemical Aspects of Air Pollution, Cortina d'Ampezzo, July 9-10, 1969.)

Liquefied petroleum (LP) gas is seldom used for motor vehicles on the highway, even though its use would reduce air pollution problems, but is used in industry and commercial establishments to operate the motors of lift trucks for loading, unloading, transporting, and stacking goods. A series of experiments were made with a Towmotor model lift truck, type 461 HF, with a 4-cylinder continental motor, 2400 rpm, lifting power 2000 kg. The truck was operated for a total of 8450 hours during the experiment. The fuels used were 84 RO gasoline and propane-butane (LP gas). It was operated under simulated operating conditions with a load of 1000 kg as well as in an idling state at approximately 500 rpm. The exhaust gases were collected, dried, and filtered through glass wool and cellulose triacetate. Aspiration was by means of a vacuum pump, with a constant flow of 2813 l/m. Extracts were prepared in a Soxhlet apparatus with cyclohexane for a period of 20-30 hours. The extract was adsorbed in a column of alumina and separated chromatographically. Quantitative determinations of aromatic polycyclic hydrocarbons (APH) were made by spectrophotometry. The gasoline exhaust contained 19 identifiable APH, some of which were known to be carcinogenic. The LP gas exhaust contained 18 APH. Qualitative differences were very slight, but the APH emissions from the gasoline exhaust were considerably higher in quantity, with the exception of fluorene, anthracene, and antenthrene. Tests with an idling motor at 500 rpm produced considerably less concentrations of the individual hydrocarbons for both fuels, with the exception of naphthalene.

6278 APTIC NUMBER 16627

Eyzat, P. and J. C. Guibet
EXPERIMENTAL AND THEORETICAL STUDY ON THE FORMATION OF NITROGEN OXIDES IN ENGINES. (Etude experimentale et theorique de la formation des oxydes d'azote dans les moteurs). Text in French. Rev. Inst. Franc. Petrole Ann. Combust. Liquides (Paris), 22(4):689-712, April 1967. 28 refs.

An experimental and theoretical study of the concentration of NO + NO2 yields (NOx) in the exhaust gas of two spark-ignition and two diesel-type internal-combustion engines of specified characteristics lead to a numerical method for its calculation under a large variety of operating conditions. (NOx) was measured with about 10% accuracy by a variant of the spectrocolorimetric azo-dye method varying the richness of the air-fuel mixture, the inlet pressure, the degree of advancement of ignition, the compression ratio, the speed of rotation, and, in the diesel-type only, the operation without or with the use of an antechamber. Curves illustrating the variation of (COx) with these parameters are shown in graphs. Chemical-equilibrium methods of analysis were inapplicable within the short combustion period in the combustion engine, for a theoretical interpretation of their data, thus the evolution of the process N2 + O2 yields 2NO was determined throughout that period. The propagation was determined within the combustion space of volume V of a reaction-front separating a region of volume Vf occupied by the fresh air-gas mixture from a region of volume VB equals V-VF occupied by the burnt mixture as determined by the richness of the fresh mixture; by the rate of formation of NO at any given NO-concentration, temperature and volume; by the time-variation of the cylinder volume V, via crankangle, connecting rod/crank length ratio, and rpm; and by that of the cylinder pressure P, by the thermostatic relations between volume, temperature and pressure of either mixture for small adiabatic changes of state considering either as an ideal gas (of different heat capacity), as well as the amount of heat released during this change. The set of known interrelations among these, and other, variables was programmed for numerical computation on computer of the variation of (NOx) in the exhaust gas with the richness of the air-gas mixture under different operating conditions, as well as of other functional relations of interest. The agreement between the calculated and measured values for the same conditions was satisfactory. The program for determining the operating conditions for which (NOx) is a minimum is under preparation.

6279 APTIC NUMBER 16298

Fiala, Ernst and Ernst-Georg Zeschmann
ANNOYANCE CAUSED BY ODOROUS EXHAUST GASES. (Laestigkeit von Abgasgeruch). Text in German. VDI (Ver. Deut. Ingr.) Z. (Duesseldorf), 109(24):1139-1141, 1967. 5 refs.

The intensity of odors caused by automobile exhaust gases was evaluated by measuring the odor intensity of dilutions of the exhaust gas with fresh air that exceeded the odor threshold. The tests were performed with a water-cooled four-cylinder, four-stroke Otto engine. The measurements were based on the following considerations. At low traffic density i.e., on well-ventilated streets, the exhaust gas odor is not noticeable; the odor threshold is not reached. With increasing traffic density, i.e., less ventilation, odor threshold is exceeded. The mass flows emitted under the latter condition were indicative of the dilution which was the measure for the odor intensity. The results showed the familiar independence of carbon monoxide and hydrocarbon concentrations from engine operating state. Test personnel could smell the exhaust gas independently of the operating state at 800- to 1000-fold dilution. The carbon monoxide and hydrocarbon concentrations at the moment the odor threshold was exceeded were between 1 and 100 ppm and 0.6 to 8 ppm, respectively. Addition of air in the exhaust system reduced the concentrations, but increased the odor intensity.

6280 APTIC NUMBER 16254

EFFECTS OF VARIATIONS OF THE WASTE COMPOSITION ON DESIGN PARAMETERS OF INCINERATORS. (Die Auswirkungen von Schwankungen der Muellbeschaffenheit auf einige Konstruktionsparameter von Muellverbrennungsanlagen). Brennstoff-Waerme-Kraft, 20(9):428-429, 1968. 1 ref. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 6p., Sept. 25, 1969. (Presented at Winter Annual Meeting of the American Society of Mechanical Engineers, Pittsburgh, Pa., 1967.)

A computer program was developed to find the limits within which the waste composition may change and to find the effects of the changes on the various parameters. The program is executed with the following values: upper heating value from 2225-4450 kcal/kg, carbon from 24-40S%, hydrogen from 3.5-7.5%, oxygen from 20-30%,

water from 11-30%, incombustible material from 11-22.5%, and carbon/hydrogen ratio from 10.8-24. It was shown that the heating value increases with increasing content of free hydrogen. If the waste composition and heating value, air surplus, and heat loss are given, the combustion products at a capacity of 900 kg/h can be found with the computer program. The specific heats and enthalpies can be found and a heat equation can be established to determine the equilibrium gas temperature. The computer program also helps to find the amount of water required for cooling flue gases to 540, 400, 260, 120 C, or to saturation. It also determines the mass and volume flow at every important point in the circulation. All calculations include a certain assumed percentage of incombustible material. An air surplus from 40-300% and a heat loss from 2-60% of the entire released heat are included in the input data. With this program, 2310 various cases can be computed and 70,000 individual data for 21 different waste compositions can be obtained. By feeding the results of analysis of the waste composition and its presumable variation over a certain period into the computer, all parameters essential for the sizing of the individual parts of the incinerator within a certain determined range can be found.

6281 APTIC NUMBER 16229

Friese, Guenther
THE ROHRBACH-LURGI PROCESS FOR THE GENERATION OF STEAM AND ELECTRICITY AND THE MANUFACTURE OF HYDRAULIC CEMENT FROM OIL SHALE. (Das Rohrbach-Lurgi-Verfahren zur Gewinnung von Dampf, Strom und hydraulischen Bindemitteln aus Oelschiefer). Erdoel Kohle (Hamburg), 14(9):702-703, Sept. 1961. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 6p., Sept. 18, 1969.

In the Rohrbach-Lurgi process, high strength hydraulic cements are produced by combustion of oil shale in fluidized-bed furnaces. The electricity required for the project is generated by the waste heat; unlike familiar low temperature processes, no oil or gas is obtained. The raw material is kept in suspension by an air stream that enters the furnace at the bottom. The turbulent movement in the suspended layer has a surface similar to a boiling fluid, making it extremely favorable for combustion and heat exchange. The good heat exchange makes it feasible to maintain a constant temperature at all points in the fluidized bed. The optimum temperature for the oil shale particles is soon reached. It is important to determine both optimum temperature and optimum residence time, since the binding property and hydraulic strength of the cement depends to a large extent on these factors. Other equipment required for the process include a waste heat boiler, gas cleaning plant, turbine, sifting, shredding, and grounding facilities, conveyance system, and measurement and control units. The use of modern control units permits fully automized operations, enabling even large plants to be run with only two or three workers.

6282 APTIC NUMBER 16135

Hashimoto, Michio and Masahiro Fujiwara
EFFECTS OF AUTOMOBILE EXHAUST GAS EMISSION ON AIR POLLUTION. (Jidoshahaikigasu no taikiosen eno eikyo). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(11):1151-1163, 1969. 25 refs.

In 1968, automobile production in Japan was almost 4,100,000 cars, a million more than produced in West Germany, and second only to the United State's production of 11,000,000 cars in the same year. While the United States, West Germany, France, England, and Italy show no annual increase, automobile production in Japan is increasing at an annual rate of 25-30%. If this rate is maintained, the approximate annual output should match that of the United Stated by 1974. It is difficult to imagine the extent of pollution by automobile engine exhaust when automobile production in a country approximately the area of California approximates that of the United States. Based on the results of measurements in several cities, the following aspects of pollution by automobile exhaust are discussed in detail: carbon monoxide emissions; dust fall including lead and pyrene; photochemical contaminations; hydrocarbon emissions; and odors. The toxicity of air pollutants for humans and vegetation is also examined. Although work on carbon monoxide began late in Japan, air quality criteria are now being formulated with respect to carbon monoxide. Air pollution from automobile exhaust is found to be increasing by approximately 10-15%. It is hoped that control policies will be in effect before automobile production reaches one car for every two individuals.

6283 APTIC NUMBER 16498

Heuser, A. H.
TRENDS IN AIR CONSERVATION IN THE GRAPHIC ARTS INDUSTRY. Gravure, 1969:22-25, 45-48, Feb. 1969. (Presented at the Fifth Graphic Arts Conference of the Technical Association of the Pulp and Paper Industry, Chicago, Nov. 1968.)

The main sources of pollution from processes involving printing and coating operations is exhaust from ovens and dryers. The principal contaminants are hydrocarbons from the solvents used in the inks and coatings. In addition, there can be some hydrocarbon residue from incomplete combustion of the fuel in flame dryers and ovens. Odors are also a problem, attributed to complex organic products of cracking and partial oxidation of resinous materials in solvents. In general, the solvents themselves are not responsible for odor complaints. Solvent emissions can be limited by direct-flame incineration or catalytic combustion, the latter technique being the more economical. Because of the possibility of catalyst poisoning or suppression, catalytic combustion may not meet Los Angeles air pollution regulations limiting solvent emissions to a maximum of 8% olefins and 20% toluene. Direct-flame ionization has been approved by the Los Angeles Air Pollution Control District. A newer approach to curtailing emissions from graphic art processes involves the use of inks and coatings which do not pollute air or require expensive effluent treatment. Ways by which this goal might be met are examined.

6284 APTIC NUMBER 16528

Hinel, Chester H.
THE OPTIMUM SIZE FOR INSECTICIDE SPRAY DROPLETS. J. Econ. Entomol., 62(4):919-925, Aug. 1969. 18 refs.

A selective review of the literature on the effect of droplet size in the control of insects shows that the optimum size for insecticide spray droplets is that which gives maximum control of the target insect with minimum insecticide and minimum ecosystem contamination. Spray droplets found to be efficient in delivery of insecticide to the target insect are those whose size allows them to be airborne and transported to the target by atmospheric transport and diffusion. Therefore, droplets must be small enough to be produced in maximum number for maximum coverage and large enough for optimum impingement. Field research data which trace the point of deposition of spray droplets by size in insect ecosystems have been obtained from the fluorescent particle spray droplet tracer method. The data indicates that optimum size is about 20 micron diameter. No data was found that would suggest the efficient delivery of droplets larger than 100 micron diameter to the target insect or its proximate foliage. Spray droplets between 50-100 micron diameter were observed to have marginal efficiency. (Author abstract modified)

6285 APTIC NUMBER 16137

Nishida, Kazuo
SMOKE PROPERTIES OF REFUSE INCINERATORS AND DUST COLLECTORS FOR THE INCINERATORS. (Gomi shohkyaku ni tomonau haigasu to sono jojin ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(10):637-645, Oct. 15, 1968. 4 refs.

Smoke from refuse incinerators is not only a cause of air pollution but a source of complaints from local residents. In Tokyo in 1967, there were 92 cases involving complaints about incinerator smoke; these constituted 12% of the total complaints concerning smoke. Refuse incineration is divided in two classes: bath combustion methods and continuous combustion methods. In batch (fixed furnace) operations, refuse is burned intermittently; the working environment in the furnace is bad. The method should be replaced by that of continuous combustion. There are also two classes of refuse: garbage and miscellaneous refuse. A mixture of the two is called a mixed refuse. Since they contain large amounts of water, garbage or mixed refuse are difficult to burn. The main components of the gas produced by refuse incineration are hydrogen chloride, sulfur oxides, ammonia, aldehydes, organic acids, and nitrogen oxides. Their concentrations can reach 2000 ppm but, with the exception of organic acids and nitrogen oxides, can be controlled to below 500 ppm. Concentrations of organic acids and nitrogen oxides do not decrease at high combustion temperatures. A solution for this problem must be found. More dust is released by batch than by continuous combustion of refuse, and sulfuric acid is its predominant component. Because of the complex nature of incinerator refuse dust, the use of dust collectors is advocated. A dry electric collector, used alone or in combination with a centrifugal collector, is recommended.

6286 APTIC NUMBER 14443

Knop, W.
AIR POLLUTION CONTROL IN NON-FERROUS METAL INDUSTRIES. II. PARTICULATE AND GASEOUS EMISSIONS OF THE NON-FERROUS METAL INDUSTRY AND EMISSION STANDARDS. (Luftreinhaltung in NE-Metall-Betrieb. II. Staub-und gasformige Emissionen der NE-Metallindustrie und die Emissionsbegrenzung.) Text in German. Metall., 22(12):1266-1271, Dec. 1968. 21 refs.

In this review article, the West German air pollution laws and regulations as applied to metallurgical plants are compiled and discussed. In the aluminum industry, dust arises both in the production of aluminum oxide from bauxite and in the electrolytic furnaces. The most dangerous component of the waste gas is fluoride of which the maximum allowable concentration is 2.5 mg/cu m. Lead refineries emit considerable amounts of dust, up to 15 g/cu m waste gas, which contains metal compounds in the form of sulfates, oxides, sulfides, and coke dust. The pollutants originating in the various steps of lead production are discussed in detail. The threshold limit value (TLV) of lead is 0.2 mg/cu m. Electrometallurgical furnaces for iron and steel alloys emit very fine dusts (less than 0.4 micrometer), typically up to 250 kg/hr at 10,000 kva capacity. Metal oxides predominate, especially iron and silicon oxides. The waste gases of copper ore refineries contain mostly fly dust and sulfur compounds. The dust contains copper, zinc, and sulfur. Typical concentrations at various stages are listed. The TLV of copper is 1 mg/cu m. Emissions of zinc plants are listed, and waste gas and soot emissions of oil, coke, and coal furnaces are discussed in detail. Special problems are posed by scrap metal refineries, where plastics and varnishes cause air pollution. Typical examples are cited.

6287 APTIC NUMBER 16116

Koehler, W.
PRESENT POSITION IN COMBATING AIR POLLUTION AND NUISANCE IN THE CEMENT INDUSTRY. (Stand der Emissionsbekaempfung in der Zementindustrie). Text in German. Zement-Kalk-Gips (Wiesbaden), 58(11):493-500, Nov. 1969. 12 refs.

Prior to a discussion of present achievements in combating pollution and noise in the cement industry, the composition of emissions by this industry is reviewed. Apart from dust, waste gases from cement kilns contain nitrogen, carbon dioxide, oxygen, and water vapor. The sulfur dioxide concentration is low because it is chemically bound as sulfate in the clinker and the dust. No gaseous fluorine emissions have ever been determined; the carbon monoxide concentration is negligible. Dust emissions sank from about 3.5% in 1950 to 1.5% in 1957, and to 0.15% of the clinker production in 1967, although the production increased from 11 million tons to 33 million tons. In the vicinity of the Westphalian industrial center comprising 15 cement plants, an average dust fall of 0.75 g/sq m/day was measured in 1950; now, the annual average is down to 0.42 g/sq m/day. The VDI (Association of German Engineers) Guideline 2094 recommends a maximum allowable emission concention of 150 mg dust/standard cu m. In 1950, only 15% of the rotary kilns were equipped with electrostatic precipitators; in 1967, more than 93% had precipitators. The VDI Guideline 2058 provides for noise abatement in the cement industry. It recommends limitation of noise in primarily industrial centers to 70 dB and in residential areas with interspersed cement factories, to 55 dB/day and 40 dB/night.

6288 APTIC NUMBER 16141

Kobayagawa, Takashi
CONTROL OF EMISSIONS FROM MOTOR VEHICLES IN EACH COUNTRY. PRESENT AND FUTURE. (Kakkoku no haishutsu gasu kisei to kongo no doko). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(11):1184-1193, 1150, 1969.

Because of differences in measurement methods, tools, and measurement conditions, it is not correct to compare automobile exhaust emissions in different countries on the basis of measured emissions. The article discusses the present and future status of engine exhaust control in the United States, Japan, and Europe. In California, control measures were first introduced in the fall of 1967; in Japan, the fall of 1966. A European standard will become effective in 1970. With respect to control measures, Japan appears to be keeping pace with other countries or even surpassing them. California has a well-known alarm standard with three levels, the first indicating that air pollution has reached a dangerous level and the second and third restricting traffic. It is said that the first level is reached at least once each year. Days when established air quality standards are exceeded increase each year. Because of the seriousness of pollution in California, the state is permitted to have standards higher than those set by the Federal government. It is hoped that the enforcement of the 1967 Air Quality Act automobile emission standards will proceed at an equal pace in all states. In limiting carbon monoxide concentrations to below 3%, Japan, like European countries, is expected to change from the present method of concentration indication to a contamination-weight indication method.

6289 APTIC NUMBER 16164

Koyama, Shingo, Yasuo Saito, Takabumi Nakahara, and Katsumi Oeya
COMBUSTION OF HEAVY FUEL OIL IN GAS TURBINE EXHAUST GAS. Mitsubishi Heavy Industries, Ltd., Tech. Rev., 6(1):62-71, Jan. 1969. 8 refs.

Investigation of the stability of the flame and the absorption of radiant heat in a test furnace revealed that flame stability became worse and radiation from flame lessened as oxygen content in combustion air decreased. Similar phenomena were observed when combustion product gas was recirculated to the burner. The amount of soot decreased and particle diameter increased when gas recirculation exceeded the limit value. The combined plant utilizing gas turbine exhaust gas is a thermal power plant. Plant equipment with specifications and a process flow diagram are presented.

6290 APTIC NUMBER 16017

Kurtzweg, J. A. and D. W. Weig
DETERMINING AIR POLLUTANT EMISSIONS FROM TRANSPORTATION SYSTEMS. Preprint, Association for Computing Machinery, New York, N. Y., 22p., 1969. 18 refs., (Presented at the Association for Computing Machinery, Symposium on The Applications of Computers to the Problems of an Urban Society, New York, Oct. 24, 1969.)

Internal combustion vehicles are a source of five major air pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, particulates, and sulfur oxides. Because vehicular pollution is essentially a problem of urbanization, analysis of its source must be carried out on a metropolitan or smaller scale. A method is presented for estimating the quantity and spatial distribution of motor vehicle emissions in a metropolitan area from established speed-emission relationships and transportation study data. On-the-road sampling of exhaust emissions from a representative sample of automobiles indicates there is a consistent relationship between average route speed and the quantity of carbon monoxide and hydrocarbons emitted. Metropolitan transportation study agencies developed detailed descriptions of future street and highway networks. The Seattle, Washington, metropolitan area was selected for the initial application of the vehicle emission estimation method because of the transportation characteristics of the area and the nature of the transportation study data available. Emissions are calculated for two 1985 street and highway networks, one based on the land use pattern predicted if existing trends within the region continue, and one based on a pattern which will exist only if certain development policies are implemented. The calculated vehicular emissions and estimated emissions from non-vehicular sources can be used with a meteorological diffusion model to predict future air quality. (Author abstract modified)

6291 APTIC NUMBER 15891

Lemaigre, P.
POLLUTION OF THE AIR BY AUTOMOBILES. FACTORS OF THE PROBLEM: THEIR REPERCUSSION ON THE DRAWING UP OF REGULATIONS AND ON MEASUREMENT METHODS. (La pollution de l'air par les automobiles. Les donnees duproblese leur repercussion sur la reglementation et les methodes de mesure). Text in French. Pollut. Atmos. (Paris), 11(Special):20-23, Feb. 1969.

Sulfur is of only slight importance in automobile fumes since it is only present in amounts of 0.0025-0.050 percent. Smoke from diesel fumes is limited to taxi fleets and is not a serious problem. The principal pollutant, carbon monoxide, also comes from domestic and industrial heating and its concentration varies widely. Also present in smaller concentrations are hydrocarbons, nitrogen oxides, lead, and the ozone which is produced by reaction with the nitrogen oxides, aldehydes and peracyl nitrates. Engine modifications in relation to proposed and present pollution regulations are then discussed. Changing carburetion is possible, that is, varying the gas-air ratio. This is impractical for various reasons, one being the varying mixtures needed for starting and then for running the engine. If the American standard of carbon monoxide at 23 g per thousand is used, the ratio of carbon monoxide to carbon dioxide is 3 percent, and change in the gas-air ratio is too slight for present analytical methods.

6292 APTIC NUMBER 16263

Ludwig, John H.
SEMINAR ON AIR POLLUTION BY MOTOR VEHICLES. Preprint, Assistant Commissioner, Science and Technology, Washington, D. C. 68p., 1970. 27 refs.

The contribution of motor vehicle emissions to community-wide air pollution problems depends on several related factors: the extent of community, commercial, and industrial sources as compared to vehicle sources; the size of the community and the distribution of these sources; topographical and meteorological factors; and the degree of control exercised for sources. The relative importance of motor vehicle emissions can be approached by evaluating specific effects, specific pollutants, and sources with respect to pollutant emissions of all types. Average emissions by sources are presented for Los Angeles County, Louisville, Detroit, and 11 Pennsylvania counties. Sources of gaseous emissions from motor vehicles are reviewed, as well as the sources of hydrocarbon and smoke emissions from diesels. California standards are reported for vehicle smoke and odor emissions, carbon monoxide, and nitrogen oxides levels. Also reported are 1970 Federal Standards for exhaust emissions from automobiles and light trucks. An attempt is made to assess specific hydrocarbon constitutents in gasoline engine exhaust, crank case ventilation, and evaporation losses, and diesel exhausts and their relationship to photochemical reactions occuring in the atmosphere. The need of continued laboratory research and detailed examination of exhausts produced by control devices is stressed.

6293 APTIC NUMBER 16125

Masek, V.
DEPOSITION OF COAL AND PITCH DUST ON AND AROUND COKE OVENS. Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), vol. 4:29-31, 1969.

The results of investigations on the amounts of dust, the composition, and the method of dissemination in pitch-coke batteries and coke oven batteries was described. Most of the dust deposited on the pitch-coke batteries was in the form of spherical particles with a minimum diameter of 0.3-0.5 micron. The majority of the dust particles which settled on coke-oven batteries had a characteristic crystalline structure. Samples of dust deposited on the top of and in the vicinity of five coke-oven batteries were analyzed. No striking differences were obtained under winter and summer conditions. Nonogeneous samples were collected to determine the contents of vitrain, clarain, durain, fusain, coke, and other constituents. It was established that the major component is vitrain. Results showed that with increasing distance from the battery, the deposits contain larger proportions of particles below 0.2 mm and smaller amounts of 3,4-benzopyrene. The highest content of 3,4-benzopyrene was found in the pitch and dust on and around coke-oven batteries. The amount of dust deposited on the coke-oven batteries depends on the charging procedure. Observations showed that ramming reduces dust emissions and loose charging increases the emissions. The results support the conclusion that strict adherence to battery operating instructions secures a major reduction in dust pollution. A further improvement can be effected by adopting the smokeless charging technique.

6294 APTIC NUMBER 16146

Ministry of International Trade and Industry, Japan. Public Nuisance Section
REMARKS ON THE RESULTS OF GENERAL SURVEY OF INDUSTRIAL PUBLIC POLLUTION IN OSAKA-AMAGASAKI AREA. (Osaka-Amagasaki chiku sangyo kogai nogochosa ni tsuite). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(8):444-447, Aug. 25, 1969.

The results of general survey on industrial air pollution conducted in Osaka and Sakai from 1966 through 1968 are summarized. The survey area covering 305 sq km of industrial sites was grouped in three districts. Half of the area was already industrialized and the remaining half in the process of industrialization. Iron-ore and petroleum refinery plants are expected to develop in the district. The fifty plants surveyed were those which generally consume heavy oil at 10 kl/H per day. Present total oil consumption is 901 kl/H and estimated consumption by 1972 is 1,433 kl/H. It is predicted that sulfur dioxide emissions corresponding to oil consumption by 1.6 fold will increase from 19,816 cu nm/H in 1967 to 27,400 cu nm by 1972. If countermeasures are not applied, industrial pollution will continue to grow. Since 1965, there has been a continuous increase in dust fall. Trial countermeasures which appear to be applicable are the conversion of heavy oil to low sulfur-content (1.7%) oil and the construction of tall stacks. If put into practice, these measures will reduce pollution by approximately 40-45% by 1972. Districts which have maintained ambient air quality standards are encouraged to use 1.5% SO2-bearing oil to compensate for estimated increases in oil consumption.

6295 APTIC NUMBER 16410

Ochs, Hans-Joachim
DUST AND GASEOUS EMISSIONS FROM POWER PLANTS. (Staub-und gasformige Emissionen von Kraftwerken). Text in German. Wasser Luft Betrieb, 12(5):284-288, May 1968. 3 refs.

The pollutants in the stack gases of power plants stem mostly from residues at the combustion of the various types of fuels used in such plants. Operation of such plants with preheated air helps to reduce the emission because fuel is saved. The higher the temperature of the added air, the less fuel is needed and the lower are the pollutant quantities in the flue gases. Three diagrams illustrate this relationship. Recent measurements in the U. S. showed that pulverized coal-fired boilers with dry slag tap-off have, on the average, pollutant concentrations between 5 and 17 g/standard cu m flue gas. A direct relationship exists between the ash content of the used coal and the possible dust concentration. The type of firing system and the composition

of the fuel influence the grain size distribution in the flue gas. The ash content of solid fuels and the C-content of liquid fuels are the major sources for solid pollutants. The VDI (Association of German Engineers) guidelines 2091 to 2093 and 2096 to 2098 are concerned with dust emissions by power plants and with means to combat such emissions. An example for the computation of the flue gas flow is given.

6296 APTIC NUMBER 16181

Odaira, Toshio
THE PRESENT STATUS OF FUEL QUANTITY FOR SALE AND OF POLLUTION IN TOKYO (I). (Tokyoto ni-okeru nenryoshiyo to taiki osen no suii (I)). Text in Japanese, Kogai to Taisaku (J. Pollution Control), 4(11):683-687, Nov. 15, 1968.

Since pollution problems at a given period in time vary according to the nature of the fuel used in the period, there can be no universal policy for air pollution control. Therefore, it is necessary to define the dilution limit of contaminants at one period and in one place. In general, emphasis is placed on the interrelation of air pollution with the demand and supply of SO2-containing petroleum and the number of operating automobiles. Fuel sales are considered an index of the total quantity of fuel consumed. According to sales data, the use of heavy oil has increased 1.98-fold in Japan over the past seven years. Prospective fuel consumption and the consequent SO2 emission extent can be calculated from this data. However, a new transition from petroleum to atomic energy became apparent, and the proportional significance of heavy oil decreased while that of low SO2-content petroleum increased. It is incorrect to assume that the future status of air pollution can be evaluated directly from the total quantity of fuel consumed.

6297 APTIC NUMBER 16144

Okano, Yukihide
DEVELOPMENT OF AUTOMOBILE TRAFFIC AND CORRECTIVE MEASURES FOR PUBLIC NUISANCE. (Jidosha kotsu no hatten to sono kogai taisaku). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(11):1145-1150, 1969.

In Japan, pollution problems generated by motor vehicle traffic are classified as a public nuisance. The suitability of this definition is discussed the viewpoint of economics. Motor vehicles are indispensable facilities, and their contribution to the economy outweighs their disadvantage as a source of air pollution. On this basis, short-range and long-range countermeasures are proposed for some traffic problems. The short-range policy is directed toward improving drivers' manners and driving conditions. The long-range policy has three stages, the first of which centers on improving streets or highways. The second stage involves the reorganization of city itself. It represents a reform of the city's function and requires changes of present land-use patterns. The third implies changes in motor vehicle design and construction. Implementation of the long-range proposals would require a tremendous amount of time and money. The short-range proposals could be put in practise today. It is obvious that the economic gains obtained from motor vehicles are impossible to replace. Even when total costs of motor vehicles, including pollution, heavy traffic, and accidents, are considered, they are still profitable.

6298 APTIC NUMBER 16268

Pavlik, I. and J. Komarek
PROBLEMS RELATED TO THE EMISSIONS OF CUPOLA FURNACES. (Problemy exhalaci z kuploven). Text in Czech. Ochrana Ovzdusi, no.7:97, 1969.

Peculiar polluting properties are attributed to the cupola furnace used in iron foundries to melt cast iron. Harmful products can be classified as follows: carbon oxides produced by imperfect combustion of the coke; sulfur oxides from the combustion of sulfur-containing materials in the coke; and various kinds of dust particles. A typical analysis of dust composition revealed the presence of SiO2, CaO, Fe, FeO, MgO, MnO, where the total dust content of the fumes was 1.2-13.0 g per standard cm. Cupola furnaces in Czechoslovakia emit a total of 4000-7000 cu m of exhaust fumes per hour, of which the SO2 content is 0.04-0.1%. The only efforts to conform to government regulations to date has been an attempt to improve efficiency of combustion in the cupola furnace. The situation calls for an optimum solution, since at the present time there are more than 130 iron foundries with something like 290 cupola furnaces, although total emissions are small in comparison with that of some other industries (cement, steel, chemical plants, etc.). The estimated output is 8500-9500 tons of dust per year, 700 tons of sulfur dioxide, and 1200-1500 tons of carbon monoxide. The prob m is complicated by the diversity of cupola furnaces, whic means that the control of emissions requires a very complex monitoring system.

6299 APTIC NUMBER 16442

Reckner, Louis R. and Robert E. Squires
DIESEL EXHAUST COMPOSITION AND ODOR. (FINAL REPORT FOR PERIOD DEC. 3, 1967 TO JUNE 30, 1968). Scott Research Labs., Inc., Perkasie, Pa., USPHS Div. of Air Pollution Contract PH 86-67-134, SRL Proj. 1076, 106p., Sept. 3, 1968. 7 refs. (Presented in part at the First National Symposium on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968.)

Reliable techniques for measuring the intensity of diesel exhaust odor using human panels were developed and evaluated in statistically-designed programs. These techniques employed panelists selected on the basis of superior olfactory ability and trained to rate dilute exhaust using a series of twelve concentrations of an odor intensity standard as the reference scale. A test program, designed to measure the difference in intensity between exhausts produced by two fuels at three operating conditions, was evaluated using both the two-cycle and four-cycle engines. A No. 2 heating oil produced exhaust with a significantly higher intensity than that produced by a No. 2 diesel fuel at idle than at half load and full load with both the diesel fuel and heating oil. The two-cycle engine exhaust had a significantly higher intensity at full load than at half load with the diesel

fuel. This program design is suitable for general use in determining exhaust intensity differences. The quality, as well as the intensity of exhaust, must be defined in order to determine exhaust acceptability in terms of human response and achieve correlation between chemical tests and panel responses. A different approach, which makes use of a technique known as selective adaption in conjunction with chromatographic separation, showed promise for characterizing diesel odor and developing adequate quality standards. It was found that selective adaption could be used to unmask minor components in odorant mixtures. Work was directed toward developing techniques for collecting exhaust carbonyls as their oxime derivatives and subsequently regenerating them for odor appraisal and identification. Reaction in aqueous and alcoholic solutions of hydroxylamine hydrochloride yielded oximes which could be converted back to carbonyls by acid hydrolysis at elevated temperatures. (Author summary modified)

6300 APTIC NUMBER 16318

Hirschfeld, Robert and Virginia Brodine
MORE LETTERS IN THE WIND. Environment, 12(1):16-26, Jan.-Feb. 1970. 15 refs.

The accidental release to the atmosphere of toxic polychlorinated biphenyls (PCB) is discussed. Like DDT, PCB contains chlorine, hydrogen, and carbon; is soluble in fat and insoluble in water; and is extremely persistent in the environment. It is found in natural and synthetic rubber, electrical products, floor tile, printer's inks, coatings for paper and fabrics, brake linings, paints, varnishes, asphalt, adhesives, and resins. In addition, PCB is used to suppress the vaporization of chlorinated insecticides. Its detection began in 1967 with the identification of 1980 ppm PCB in the fat of North American peregrine falcons and 17,000 ppm in the fat of Swedish white-tailed eagles. It is unlikely that the insecticide is the only source of contamination. Other suspected sources are stacks of the plant manufacturing polychlorinated biphenyls, industrial wastes, and the gradual wear and weathering of PCB-containing products. Little data is available about PCB in people, but a sampling of mothers' milk in Berkeley and Los Angeles showed average concentrations of 0.06 ppm of whole milk. Small amounts were present in a sample of cow's milk and higher concentrations in fish eaten by humans. Establishment of tolerance limits of PCB in food is clearly essential. It is also necessary to identify the sources of the environmental PCB residues and to trace the paths by which they move through the environment.

6301 APTIC NUMBER 16193

Shapritskiy, V. N.
COMBATING AIR POLLUTION BY EMISSIONS FROM FERROUS METALLURGY ENTERPRISES. (Bor'ba zagryazneniyem atmosfernogo vozdukha vybrosami predpriyatiy chernoy metallurgii). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities (Ozdorovleniya vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2 Kiev, Rodivel'nik, 1968, p. 47-51. 4 refs.

The numerous basic and secondary sources of air pollution associated with various types of ferrous metallurgy installations are reviewed, together with the attendant problems of abatement. Incidental cases pertaining to this subject are cited from the literature. Special attention is given to development of bag filters outside of the Soviet Union. It is noted that living quarters for workers at large installations must be situated at distances of from 6 to as much as 15 km. It is estimated that costs for pollution control will amount to 40 million rubles per year for a plant producing 5 millions tons of steel per year.

6302 APTIC NUMBER 16539

Sone, Akira
THE SITUATION AND CONTROL OF AUTOMOTIVE EXHAUST EMISSIONS IN THE MIDDLE CITY (II) IN SENDAI CITY. (Chutoshi ni okeru jidosha haikigasu to sono taisaku (II) Sendai shi ni okeru ichirei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(7):437-440, July 15, 1968.

Sendai city is a business and industrial center in northeastern Japan with a population of more than 500,000. The rate of increase of automobiles has nearly doubled since 1963, the total number in 1968 being 130,000. Present heavy traffic and automotive exhaust emissions are attributed to poor city and residential planning. Interstate highways run through the city and the total number of cars on the highways averages 13,000 per day. In a traffic survey conducted from 1961 to 1967, the average number of cars was found to be 1700 per hour. The increase in auto traffic has been accompanied by a proportional increase of CO, Pb, NO2, and dust fall. The effects of engine exhausts became apparent when the number of cars reached 2000 per hour. Carbon monoxide concentrations exceeded the emission standard of 5 ppm of Miyagi Prefecture. The maximum concentration was 31 ppm and the average, 8 to 13.5 ppm. The maximum Pb concentration was 4.26 gamma/cu m, far beyond the emission standard. Maximum dust fall was 6.8 mg/cu m, exceeding the emission standard of 2.0 mg/cu m. Before the survey, Sendai city was more concerned with industrial pollutants such as smoke and dust. The survey indicates that the effect of engine exhausts is more severe than that of industrial pollution.

6303 APTIC NUMBER 16024

Styles, M. E., J. Vrebos, and J. Lawther
PUBLIC HEALTH ASPECTS OF AIR POLLUTION FROM DIESEL VEHICLES. Preprint, World Health Organization, Geneva, Switzerland, 36p., Aug. 18, 1966. 8 refs. (WHO/AP/67.28.)

Diesel and gasoline engines are compared with regard to differences between their design and operating characteristics and differences between their exhaust products. Satisfactory combustion in a diesel engine does not require the production of an explosive admixture of vaporized fuel and air. Complete combustion is largely a matter of ensuring a correct pattern of fuel spray from injector nozzles and a suitable degree of air swirl by proper combustion chamber design. In a diesel working

at rated capacity, an excess of oxygen is always present during combustion and, in a properly maintained engine, the exhaust seldom contains more than mere traces of carbon monoxide, even though a haze of smoke is produced. As shown by analyses of smoke from intentionally maladjusted engines, diesels are not a major source of polycyclic hydrocarbons. While diesel soot has produced tumors in laboratory animals, no excess of lung cancer has been found among workers exposed to diesel exhausts. Diesel engines can be developed which meet emission standards such as those contained in the Belgian Royal Decree of 1964. Properly adjusted and maintained, these engines will not emit dangerous or dirty smoke. The use of smoke meters is recommended to check diesel smoke. Included in the appendix are measures taken to reduce air pollution by diesel buses and coaches in London.

6304 APTIC NUMBER 16239

Thring, M. W.
FUEL AND ENERGY PROBLEMS IN THE NEXT THIRTY YEARS. Preprint, Combustion Engineering Assoc. Hayes, Middx., Great Britain, 21p., 1969. (Presented at the Combustion Engineering Assoc. Meeting, London, April 10, 1969, Document 8622.)

Within the next 30 years, world fuel requirements will probably increase by a factor of the order of ten, and improved combustion engineering techniques are necessary for the proper use of world fuel resources. Even though sole drilling operations may add to the proved resources of petroleum, there are definite and foreseeable limitations to world hydrocarbon resources. Natural gas is even more limited than petroleum and also much more difficult to transport. Coal resources are at least 100 times greater than other hydrocarbon resources, and it is anticipated that electricity will be generated from coal by underground gasification and combustion processes. Development of mechanical engineering techniques should also make it possible to exploit two other sources of hydrocarbon fuels: the Athabascan tar sands and Colorado oil shales. Within the next thirty years, the cost of electricity generated by nuclear fission will drop to about half the present cost of electricity. Commercial-scale nuclear fusion processes are likely to be a reality in 40 years. Once they exist, fuel will be unlimited because deuterium is present in all water. It is hoped that the thermal efficiency of power stations will be increased by the use of multifluid cycles and by processes which will run boilers on a heavy fuel oil or will combine steam engines and gas turbines. Fuel utilization by railroads will be improved by the use of monorails driven by linear electric motors. Fuel consumption of ships and airplanes could be decreased by new propulsion methods in which surrounding air would become the propulsion jet.

6305 APTIC NUMBER 16224

Van Duuren, H. and A. J. Elshout
THE CURRENT SITUATION IN THE ELECTRICITY-GENERATING INDUSTRY IN CONNECTION WITH THE CAMPAIGN AGAINST AIR POLLUTION. (De stand van zaken bij de elektriciteitsproduktiebedrijven in verband met de bestrijding van de luchtverontreiniging). Electro-Techniek (The Hague), 44(20):459-465, 1966. 3 refs. Translated from Dutch. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 24p., May 19, 1969.

Air pollution problems of power stations in the Netherlands were discussed. Control of air pollution is receiving full attention on the part of these industries. Data from stations in operation from 1954 to 1965 provide a description of the measures taken to avoid pollutant emissions, including flyash collectors and higher chimneys. Since the increasing demand for power is to a considerable extent covered by the delivery of electricity, the shift thereby developing from the fueling of small installations and small power plants to large power plants already signifies a positive contribution to combatting air pollution. It is also possible to make air pollution control a substantial part of the operating management by big investments in the field. Measurements of the short-term concentrations of SO2 around a number of power plants showed that these concentrations were lower than the maximum allowable concentrations. The long-term average concentration due to the stations was only a small part of the total ground-level concentration. In spite of the great increase in electricity productions and the resulting increase in fuel consumption, the increase in air pollution in the Netherlands is not disquieting as a result of the measures taken by the power plants.

6306 APTIC NUMBER 16256

Walker, P. E. and F. E. Hartner
FORMS OF SULFUR IN U. S. COALS. Bureau of Mines, Information Circ., no. 8301, 51p., 1966. 2 refs.

Knowledge of the form in which sulfur occurs in coal is basic in the development of improved sulfur removal methods. Sulfur does not occur as an element in coal, but three sulfur forms in chemical combination are present: combined with the organic coal substance (organic sulfur); combined with iron as pyrite or marcasite (pyritic sulfur); and combined as calcium and iron sulfates (sulfate sulfur). Forms of sulfur are determined on samples of air-dried coal crushed to pass a 250-micron sieve. The sulfate sulfur is extracted from the coal with dilute hydrochloric acid. The pyritic sulfur is extracted from the hydrochloric acid residue portion of the sample with dilute nitric acid. The pyritic sulfur is then determined from the nitric acid soluble sulfur and by calculation from the pyritic iron which is the nitric acid soluble iron. The organic sulfur is taken as the difference between the total sulfur and the sum of the pyritic and sulfate sulfur. A step-by-step procedure for the determinations was presented. Total sulfur and sulfur forms for coal in 283 counties in 29 States and 2 fields of the State of Alaska were determined. Samples totaled approximately 2900 which included most of the coalbeds in the United States. The results were presented in tabular form.

6307 APTIC NUMBER 16216

Warous, D. and B. Maizier
ELECTRICAL PROPERTIES OF FLAMES USED FOR AUTOMATIC CONTROL OF BURNERS. (Proprieta elettriche delle fiamme usate per il

controllo automatico dei bruciatori). Text in Italian. Gas (Rome), 16(10):322-327, Oct. 1966.

The article discusses the use of 'ionization' electrodes as safety devices protecting against the eventuality of flame extinction. It is devoted to a theoretical discussion of the electrical properties of flames and description of a new 'self-monitored' burner. The question of air pollution occurs in connection with a practical application of the new burner, which needed to be cleaned frequently to insure its efficiency, due to the high content of grease and paint in the particular atmosphere of the plant where it was tested.

6308 APTIC NUMBER 16526

Wheatley, G. A. and J. A. Hardman
INDICATIONS OF THE PRESENCE OF ORGANOCHLORINE INSECTICIDES IN RAINWATER IN CENTRAL ENGLAND. Nature, 207(4996):486-487, July 31, 1965. 5 refs.

Rainwater samples collected from a locality in central England were analyzed for organochlorine insecticides by both thin-layer and gas/liquid chromatographic techniques. Quantitative estimates (90% for dieldrin, 70% for gamma benzene hexachloride (BHC), and 50% for DDT) were obtained by comparing the peak heights on the gas chromatograms of samples extracted with hexane with those given by standards prepared from analytical grade specimens of the insecticides. All the rainwater samples examined yielded solutes identical in behavior to gamma-BHC and dieldrin in both the thin-layer and gas/liquid chromatographic systems. A solute corresponding to the behavior of p,p' DDT was also detected. The concentrations of the solutes varied from month to month and appeared to be independent of the total monthly recorded rainfall. It is concluded that apparent increases in residues in untreated droplets could not be accounted for by fallout of insecticide in the rain, since calculations showed that one part of solute could deposit only 2.7 mg of solute per acre for a 24-in. annual rainfall.

6309 APTIC NUMBER 15883

Winkler, G. L., S. S. Lestz, W. E. Meyer
EXHAUST GAS SAMPLING TECHNIQUE FOR RELATING EMISSIONS AND CYCLE CHARACTERISTICS. Preprint, Society of Automotive Engineers, Inc., New York, 5p, 1968. 10 refs. (Presented at the National Fuels and Lubricants Meeting, Tulsa, Okla., Oct. 29-31, 1968, Paper 680770.)

For investigating whether or not there is a correlation between the irregularity of combustion processes in spark engine ignitions and undesirable emissions, a sampling system was developed which collects bag samples from specified cycles only. It consists of an analog portion for obtaining pressure and rate-of-pressure change signals, a digital logic portion for discriminating between signals according to selected criteria, and an electrically actuated sampling valve in the engine exhaust system. Since signal analysis and discrimination are instantaneous, gas sampling is done during the exhaust stroke of the same cycle for which the logic generated the command to sample. An analysis of the total unburnt hydrocarbons from 600 bag samples shows that there is a separation in the amount of unburnt hydrocarbons according to the magnitude of the peak rate of pressure change. The separation is repeatable for a given engine condition and supports the assumption of a relationship between exhaust gas composition and the physical characteristics of the cycle. (Author abstract modified)

6310 APTIC NUMBER 16319

Aaronson, Terri
TEMPEST OVER A TEAPOT. Environment, 11(8):23-27, Oct. 1969. 1 ref.

Hearings of the Senate Commerce Committee and the Subcommittee on Air and Water Pollution of the Committee on Public Works have focused on alternative power systems to the internal combustion engine, particularly the Rankine, or vapor-cycle, propulsion system. In terms of cost, size, and efficiency, this engine appears to be the best alternative. Basically, it consists of a closed tube containing a working fluid which is heated externally by a burner using low-grade gasoline or kerosine. The working fluid, transformed to a vapor, drives either pistons or a turbine. The vapor is then condensed and recycled. By allowing fuels to be burned more completely than in the internal combustion engines, the process greatly reduces emissions. It is the opinion of the Commerce Committee that the Rankine engine will be at least equal to and better than the internal combustion engine in terms of maintenance and reliability. According to one research report, the cost of the engine be equal to that of an equivalent V-8 engine with automatic transmission. Present obstacles to its wide acceptance are the inertia of the automobile industry and the petroleum industry to remodel its refineries for low-grade kerosine production. However, development of the engines could be hastened by a government-created demand for low-emission vehicles.

6311 APTIC NUMBER 16326

Acres, G. J. K.
PLATINUM CATALYSTS FOR THE CONTROL OF AIR POLLUTION. Platinum Metals Rev., 14(1):2-10, Jan. 1970. 5 refs.

A new platinized ceramic honeycomb catalyst marks a major advance in the use of catalysts for controlling gaseous organic pollutants. The thin wall honeycomb structures have a high surface-to-volume ratio which makes them as good or better than pelleted catalysts. The honeycomb supports also have a high thermal shock resistance and structural strength; unlike pelleted catalysts, they are attrition resistant. The catalyst is stable in either oxidizing or reducing conditions up to 750 C. Homogeneous distribution of the platinum in the honeycomb structure is obtained by impregnating the support with aqueous chloroplatinic acid followed by a gas phase reduction in hydrogen. The ignition temperatures on the catalyst for a wide range of molecules often encountered in polluted air are tabulated. On the catalyst, the temperature required for conversions higher than 90% is usually 50-100 C higher than the ignition temperature. When the temperature is above that required for ignition, the catalyst can be placed directly in the gas stream. Examples of this use are wire-enamelling ovens, some paint-drying ovens, self-cleaning cookers, and diesel or internal engine combustion systems.

6312 APTIC NUMBER 14448

Agneray, Louis, Maurice Brumi, Gerard Vandenbussche, and Arlette Clayer
RECOVERY OF NITROGEN OXIDES FROM INDUSTRIAL WASTE GAS BY COUNTER-CURRENT ADSORPTION. (Die Wiedergewinnung von Stickoxiden aus Industriegasen durch Gegenstromadsorption.) Text in German. Dechema Monograph, 59(1045-1069):139-146, 1968. 2 refs.

Nitric acid factories emit waste gases which contain considerable amounts of nitrogen oxides. Adsorption by silica gel seemed to be an economical method of recovery, so this method was tested. The adsorbent descended a vertical column countercurrent to the gas which was to be cleaned. First the water and then the NO2 were adsorbed. Due to the catalytic action of the silica gel, NO is converted into N2O3 or NO2, which is likewise adsorbed. The adsorbent is recycled by pneumatic transport, but prior to that, it is desorbed by the simultaneous effect of heat and dry gas, the latter being a portion of the cleaned gas. The desorbed mixture is similar to the gas entering the column, except that it contains denser nitric oxide gases, water vapor, and nitric acid. It can thus be recycled to the nitric acid production line or it may be condensed to a weak nitric acid. The column gas a diameter of 10 cm and a height of 3 m divided into 3 zones for adsorption, concentration, and desorption. Silica gel with grain sizes from 0.71 to 0.84 mm was used. The temperature of the incoming water-saturated gas was about 40 C and its pressure somewhat more than 1 atm. The gas contained 0.4% by volume NO2 and 0.2% by volume NO; flow rate of the adsorbent was about 0.25 m/sec. Measurements of the cleaned gas indicated that it contained less than 50 ppm of nitrogen oxides. The gas developing upon desorption contained more than 5% nitrogen oxides. Based on experimental data, a column with a diameter of 2.50 m and a height of 17 m would be needed to clean 20,000 cu m/h of a gas of composition similar to that for the experiments. Such an adsorption column would consume 15 kwhr. The main advantage of this method is the low operating cost.

6313 APTIC NUMBER 16711

BAG LIFE EXTENDED AT COPPER REFINERY. Air Eng., 11(1):18-19, Jan. 1969.

Conversion from glass fiber fabric to a filter fabric made of DuPont's high temperature fiber, Nomex nylon has increased the effective life of copper refinery filters by at least a factor of 14. The requirement was for a material which could withstand continuous exposure to 350 F, the abrasion of an inert oxide dust, and the flexing resulting from periodic shaking to drop the accumulated cake from the interior of the bags to the collecting bins below.

6314 APTIC NUMBER 16185

Aoi, Katashi
A CLEANING DEVICE FOR AUTOMOBILE EXHAUST GAS. (Jidosha haikigasu seijosochi). Text in Japanese. (Assignee not given.) Japanese Pat. Sho44-22568. 3p., Sept. 26, 1969. (Appl. May 30, 1966).

A cylinder for cleaning automotive exhaust gas consists of gas expansion and condensation chambers. Exhaust gas from gasoline,

diesel, or propane gas engines is adiabatically expanded in these chambers. The inlet of the cleaning cylinder is connected to a preprocessing cylinder that draws in the exhaust gas in a tangential direction and operates like a transverse-type cyclone during an adiabatic expansion of the gas. The preprocessing chamber houses an inner cylinder having numerous holes. A deposition chamber is provided outside the inner cylinder. Here water containing harmful components or carbon particles are deposited after being separated by the porous inner cylinder. The water deposit is periodically collected. The remaining gas is led to the cleaning cylinder and subsequently discharged. The cleaning cylinder is divided into a number of compartments, the last of which is filled with an oxidizing catalyst for carbon monoxide. Since the exhaust gas temperature is low at this stage, the catalyst works efficiently and lasts long. The present invention is an improved version of the inventor's patent, Sho40-9643, which does not have a preprocessing cylinder.

6315 APTIC NUMBER 15841

Atsukawa, M., Y. Mizumoto, and M. Tsuda
REMOVAL OF SULFUR DIOXIDE GAS BY FERRIC HYDROXIDE. (Sanka-yuo gan'yu gasu no suisanka-tetsu niyoru shori-hoho). Text in Japanese. (Mitsubishi Heavy Industries, Ltd., Tokyo, Japan) Japanese Pat. Sho43-11648. 3p., May 16, 1968. (Appl. Feb. 23, 1962, claims not given).

Sulfur dioxide from the exhaust gas of industrial plants, expecially of steam power plants, is collected by the use of ferric hydroxide aerosol with formation of ferric sulfate which is then converted by Mn2O3 into the ferric hydroxide to be recycled for the collection of SO2. The temperature of the SO2 which passes the collection hearth is between 100 and 300 C and it contacts the aerosol for 1.03 sec. The collection efficiency in this process is 97.3% and the sulfates produced during the procedure are changed into useful by-products. The gas exhausted after this procedure includes no humidity, and there is no need of a tall chimney to prevent air pollution. Thus, this method is most convenient and economical.

6316 APTIC NUMBER 15844

Atsukawa, M., K. Nishimoto, and Y. Mizumoto
REMOVAL OF SULFUR DIOXIDE GAS BY MANGANESE OXY-HYDROXIDE. (Sanka-yuo gan'yu gasu no okishi-suisanka mangan niyoru shori-hoho). Text in Japanese. (Mitsubishi Heavy Industries, Ltd., Tokyo, Japan) Japanese Pat. Sho42-14712. 4p., Aug. 17, 1967. (Appl. Dec. 27, 1963, claims not given).

Manganese oxy-hydroxide (MnO(OH)) is used as an absorbent to remove sulfur dioxide from the exhaust gas of sulfuric acid factories, metal refineries, or steam power plants. The absorbent MnO(OH) is either sprayed as a mixture with manganese sulfate (wet process) into the exhaust gas or is placed in a bed as granules or powder while the exhaust gas passes over it (dry process). The temperature required for reaction is 55 C in the wet process and 150 C in the dry process. The SO2 removal efficiency is 97.2% in the former process and higher than 99% in the latter process. The manganous sulfate obtained in these processes is later converted to MnO(OH) by adding ammonia and oxygen within a glass cylinder. The ammonium sulfate obtained here may be later converted to ammonia by adding CaO or Ca(OH)2. Thus, MnO(OH) and ammonia can be reused in this procedure, making it one of the most convenient and economical processes for removing SO2 from the exhaust gas of industrial plants.

6317 APTIC NUMBER 16548

Atsukawa, Masumi
REMOVAL OF SO2 FROM FLUE GAS OF THERMAL POWER STATION. (Karyoku hatsudensho haien chu no aryusan gasu no jyokyo ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(4):219-224, Oct. 15, 1965.

The flue gas of a thermal power station contains 0.12 to 0.16% sulfur dioxide, an amount far lower than the allowable limit stipulated in the Smog Control Law. However, the emissions are a serious nuisance. The four important countermeasures are the use of low sulfur-content fuel, limiting the scale of power stations, diffusion of smog by tall chimneys, and desulfurization of flue gas. The first three do not give satisfactory results. The desulfurization of flue gas is more difficult by the thin concentration and large quantity of gas, low price of by-products, and so on. The desulfurization method is divided into wet and dry methods. Drawbacks of the wet method are the large quantity of water contained in the tail gas and its low temperature. The wet methods are subdivided into ammonium sulfate, gypsum, red mud method, etc. The desulfurization rate of ammonium sulfate method is 97% for flue gas containing 0.1 to 0.2% sulfur dioxide. The gypsum method can treat 62,500 N cubic meters gas containing 3% sulfur dioxide in a day. A new catalyst for use in dry desulfurization processes is activated manganese oxide. As determined by pilot plant studies, the desulfurization rate of this method is 90% for flue gas containing 0.1% sulfur dioxide. The dust collection rate is 99% using a mechanical and electrical dust collector. Tail gas temperature is maintained above 100 C.

6318 APTIC NUMBER 15878

Bacon, Raymond F. and Rocco Fabelli
RECOVERY OF SULPHUR DIOXIDE FROM GASES. (Assignee not given.) U. S. Pat. 2,142,987. 3p., Jan. 10, 1939. (Appl. Dec. 24, 1935, 3 claims).

Sulfur dioxide can be recovered from mixtures, either in gaseous or liquid form, by treating gases with an aqueous solution of a free weak acid and a salt of a water-soluble weak acid. Suitable acid salts include acetic, benzoic, fumaric, lactic, phosphoric, citric, and tartaric. The free weak acid can be the same as that forming the salt. The salts react with sulfurous acid to regenerate the weak acid and produce a sulfite which decomposes under the influence of heat with the liberation of sulfur dioxide. They are stable and nonvolatile at the temperature used for the liberation of sulfur dioxide. The amount of weak acid employed should be equivalent to 68 grams of lactic acid

per liter. Such an amount materially increases the rate of liberation of sulfur dioxide from the absorption solution at its boiling temperature as compared with the rate of liberation of sulfur dioxide at the boiling temperature from a similar absorption solution containing no free weak acid. The process is an economical way of producing sulfur dioxide-bearing reagents for various chemical and metallurgical uses as, for example, in the production of sulfuric acid, in the production of elemental sulfur, in the refrigeration and leaching of ores, and in the production of sulfite cooking liquors.

6319 APTIC NUMBER 16459

Basmanov, P. I. and P. A. Burovoy
FILTERS WITH FILTER MATERIAL FP FOR FINE PURIFICATION OF GASES. (Fil'try s fil'truyeshchim materialom FP dlya tonkoy ochistki gazov). Text in Russian. Khim. Prom. (Moscow), no. 12:31-32, 1967. 8 refs.

Engineering information on the FP-brand (F equals filter, P equals Petryanov) of filter materials is presented, in addition to the disposable ready-made filter units incorporating it, which are widely used in the USSR as the finishing stage of air or gas filtering installations. These materials are produced in layers of various thicknesses of perchlorovinyl fibers. 1.5 or 2.5 micron in diameter or of acetylcellulose fibers, 1.5 micron in diameter. Their designations specify their brand (FP), the plastic used (P or A), the fiber diameter, and the standard resistance to air flow in mm H2O cm, of the given thickness of the filter material as measured at the air speed of 1 cm/sec, that is, at the volume rate of flow of 36 cu m/hour per 1 sq m of the layer surface. Brands FPP-15 and FPP-25 are hydrophobic, acid- and base-resistant, but not resistant to oils or organic solvents, and operate at gas temperatures of up to 60 C and gas humidities of up to 99%. FPA-15 is hydrophilic, acid-, base- and oil-resistant, but not resistant to organic solvents, and operates at temperatures of up to 150 C and gas humidities of up to 80%. Brand FPP-15-1.5 has a specific loading capacity of up to 150 cu m/hr sq m and a minimum cleaning effectiveness of 99.0 to 99.99% with aerosols of 0.1 to 0.2 micron mean diameter and is used for cleaning inlet air and non-toxic outlet air as well as in recirculating dust removal and air conditioning. FPP-15-3, FPP-25-3, and FPA-15-4 have the same specific loading capacity, but their minimum cleaning effectiveness varies between 99.90 and 99.99%; they are used for outlet air or gas with radioactive or toxic aerosols as well as for sterilizatin of air or other gases. FPP-15-4.5 also has the same specific loading capacity, but its minimum cleaning effectiveness varies between 99.90 and 99.995%; it is used for outlet gases from hot protective chambers and boxes. Finally, FPP-15-6, FPP-25-6 and FPA-15-6 have a specific loading capacity of up to 72 cu m/hr sq m and a minimum cleaning effectiveness of 99.990 to 99.9995%; they are used for cleaning highly toxic and radioactive outlet air or gases of industrial plants. A table lists the overall dimensions, operational characteristics and typical uses of 33 filter units incorporating FP-brand filter materials. The service life of this type of filter may be as long as 4000 to 5000 hours.

6320 APTIC NUMBER 16301

Bauer, Karl
COMBUSTION PROBLEMS DURING PARTIAL LOAD OPERATION OF THE TWO CYCLE OTTO ENGINES WITH CRANKCASE SCAVENGING. (Beitrag zur Klaerung von Verbrennungsproblemen bei Teillast kurbelkasten-gespuelter Zweitakt-Ottomotoren). Text in German. Munich Technical Univ., Thesis (PhD), 1968, 110p. 70 refs.
CPSTI: N69-21744

Experiments on one and three cylinder two-stroke Otto engines were conducted to study and solve idling and knocking problems. A gas sampling valve installed in the vicinity of the spark plug with short sampling time was used to determine the composition of the air/fuel mixture in the spark plug at the time of ignition. The gas samples were analyzed with an Orsat absorption analyzer and a Draeger trace gas analyzer. In addition, pressure measurements were taken and ionization probes, temperature sensors, and photo cells used to follow the combustion process from beginning to end. If the scavenging system remained unchanged, the air consumption determined the ignition in the idle. Delayed ignition required an opening of the throttle valve and thus increased the air consumption. An ignition ratio (number of strokes with combustion divided by total number of strokes with and without combustion) of almost 100% was obtained as against 20% in the beginning. Gas analyses showed no higher emission of CO and CH. Delayed ignition, however, causes knocking at higher rpm (2500 to 3500 rpm, pressure 0.1 to 0.4 kgf/sq cm). This can be mitigated but never eliminated by an early ignition. Knocking could be eliminated if a minimum air consumption of 30 to 35% for scavenging could be maintained. Precise control of spark timing and of the air ratio, however, requires costly design modifications and is therefore not feasible.

6321 APTIC NUMBER 16282

Bechtel Corp., San Francisco, Calif.
ALKALI SCRUBBING TEST FACILITY. PHASE I: PRELIMINARY ENGINEERING. NAPCA Contract PH 22-68-27, 332p., May 1969. 124 refs.

Comparative tests of various scrubbers was carried out to identify those meeting the requirements of limestone injection-wet scrubbing process for removing sulfur dioxide and particulates from waste gases emitted by coal-fired power plants and industrial complexes. The criteria used in selecting scrubbers were pressure drop, turndown capability, plugging characteristics, mist elimination, and scrubber liquid requirement. The data obtained for each scrubber are tabulated, as are estimated capital and operating costs. Less expensive design alternatives are considered. Also studied was the chemistry of SO2 absorption. In the limestone scrubbing process, which circulates a solution saturated with CaSO3, the shift from monosulfite is considered the key mechanism responsible for absorbing SO2 from flue gas. This means that the solution entering the top of the scrubber need not contain Ca(OH)2 if the required stoichiometric amount of CaSO3 is present. The pH of the liquor entering the absorber should be between 6-7. As the liquid passes through the absorber, it absorbs SO2, sulfite shifts to bisulfite, and the pH falls to between 5-6. In the liquor circuit outside the scrubber, solution

occurs and Ca(OH)2 forms which then reacts with bisulfite to precipitate CaSO3. The circulation rate required for given SO2 concentrations is determined by the solubility of CaSO3. If the rate is too large, a slurry can be used. Final evaluation of scrubber performance in laboratory facilities will require more data on sufficient gas-liquid phase equilibrium for gas-phase SO2 concentrations.

6322 APTIC NUMBER 15853

PROCEDURE FOR ADSORPTION OF IMPURITIES, IN PARTICULAR OF SULFUR DIOXIDE, CONTAINED IN WASTE GASES. (Procede d'adsorption des impuretes, en particulier de l'anhydride sulfureux, contenues dans les gaz d'echappement). Text in French. (Bergwerksverband G.m.b.H., Essen, W. Germany) French Pat. 1,495,695. 7p., Sept. 22, 1967. (Appl. Sept. 30, 1966, 6 claims).

The invention concerns a procedure for adsorption of waste gas impurities, in particular, of SO2, by means of a moving layer of granular adsorbent carried by a wire mesh conveyor which is tranversed in the adsorption chamber by the waste gas stream countercurrent to the conveyor motion. After leaving that chamber, the impurity-laden adsorbent is first freed of trapped dust and then travels through a trough filled with a desorbent liquid followed by recycling. The desorbent liquid moves in counterflow through the moving adsorbent layer, leaves the trough at the point of entry of the dust-free adsorbent and returns through an external conduit to the point of departure of the regenerated adsorbent to be recirculated. Used desorbent liquid is removed from the closed circuit and replaced by fresh liquid as needed during its passage through the external conduit. Several design variants of devices for implementation of the above procedure are included.

6323 APTIC NUMBER 16156

Fernhart, Alfred
AIR POLLUTION CONTROL EQUIPMENT FOR CARS. Eng. J. (Toronto), 52(12):12-16, Dec. 1969. 15 refs.

In North American cities, cars, trucks, and aircraft contribute 57% of the air pollutants; in Los Angeles, the percentage is 68%. At 50 mph, the average car emits 80 cu m/hr of exhaust gases which contain 17 lbs/hr carbon dioxide, 3.5 lbs/hr carbon monoxide, 0.5 lbs/hr hydrocarbons, 0.5 lbs/hr nitrogen oxides, 4 gram/hr of lead particles, and 0.4 to 0.7 micrograms of benzo(a)pyrene. Engine exhausts contribute 97% of the total carbon monoxide emission, plus 65% of the total hydrocarbons, plus 100% of the nitrogen oxides; crankcase ventilation, 3% of the total carbon monoxide, plus 25% of hydrocarbons; carburetor, 5 to 10% of hydrocarbons; and the gasoline tank, 10 to 15% of the hydrocarbons. Combinations of crankcase emission return systems, evaporation proof carburetors and gasoline tanks, crankcase control devices, engine modification systems, or air injection systems should reduce daily emissions to 2.4 lbs of carbon monoxide, 0.05 lbs of hydrocarbons, and 0.08 lbs of nitrogen oxides. The devices will not reduce carbon dioxide emissions, which are expected to increase from 40 to 52 lbs per day. The cost of these devices will account for only 1.5% of the purchase price of a car.

6324 APTIC NUMBER 16242

Blomen, T.
THE ROSENBLAD SYSTEM FOR RECOVERY OF HEAT AND SULPHUR DIOXIDE IN THE CHEMICAL WOOD PULP INDUSTRY. Tech. Assoc. Pap., Ser. 20, no. 1:346-348, June 1937. (Presented at the Annual Meeting of the Technical Association of Pulp and Paper Industry, New York, N. Y., Feb. 22-25, 1937.)

A new storage system for recovering waste heat from wood pulping operations is economical to operate at peak loads and enables exhaust vapors from digestors and waste vapors from other mill departments to be utilized. Blow steam is pumped to an accumulator to start the circulation of water from the bottom of the tank through a jet condensor to the cyclone top of the tank. In the jet condensor, steam is condensed by the cold water, raising the temperature of the water to 203 F. The steam condensate is passed to the top of the tank, together with the cooling water. In the tank, the heat exchanger and its pump are so proportionated that there is a distinct demarkation between hot and cold water. Hot water from the top of the tank is pumped off and cooled to 104 F. The cooled water is then returned to the suction side of the cold water pump or to the bottom of the tank. Water to be heated is brought from outside the heat exchange to a hot water tank rather than heated directly in the jet condensor because vapors coming from digestors are general mixed with black liquor and odorous gases. These impurities are caught by the cooling water in the jet condensor and filtered off. Sulfur dioxide is similarly recovered by adding a gas cooler to the top of the accumulator. The system is appropriate for both sulfate and sulfite mills.

6325 APTIC NUMBER 16566

Blyakher, I. G., L. Ya. Zhivaikin, L. V. Sazhaeva, I. F. Morozov, and V. S. Gerasimov
PURIFICATION OF EFFLUENT GASES FROM SO2 IN THE PRODUCTION OF SODIUM BISULFITE BY MEANS OF SULFITE - CAUSTIC SOLUTION IN AN APPARATUS WITH MOVABLE PACKING. (Ochistka otkhodyashchikh gazov proizvodstva bisul'fita natriya ot SO2 sul'fitno-sodovym kastvorom v apparate s podvizhnoy nasadkoy). Text in Russian. Khim. Prom. (Moscow), no. 11:855-857, 1969. 7 refs.

The effect of different parameters on effectiveness of an apparatus with movable packing for sulfur dioxide absorption from effluent gases in the production of sodium bisulfite was studied. The quantities characterizing the effectiveness of the apparatus were the degree of absorption, C, and coefficient of mass transfer, K. Slight variation in initial SO2 concentration and in concentration of absorbing solution had no effect on K and C. Variation of hydrodynamic parameters, melting density, a, and flow velocity of gas, W, were not determining factors in optimum conditions of absorption. For W equals 3-4.2 and Q equals 8-20, with increasing W and Q, the coefficient of mass transfer, K, increased. The maximum value of C obtained under optimum conditions was 99.5%. For initial SO2 concentration between

.2-.4%, K was expressed as K equals 13 WQ to the zeroth or first power. The dependence of K and C on hydraulic resistance as well as the latter as a function of Q and W are presented in a graph. On the basis of these, the absorption conditions can be chosen according to pressure losses in the apparatus. The latter determine also the height of the movable packing layer.

6326 APTIC NUMBER 16602

Bondarenko, I. P. and Ye. Kh. Zeaskaya
EFFECT OF TEMPERATURE ON THE OPERATION OF THE ARSENIC-SODA DESULFURIZATION PROCESS. (O vliyanii temperatury na rabotu mysh'yakovo-sodovoy seroochistki). Text in Russian. Koks i Khim., no. 6:54-56, 1965.

In addition to the Na2CO3/As2O3 ratio and the pH value of the absorbent solution, and the consumption of air for regeneration of the saturated solution, temperature should be considered a basic parameter of the industrial arsenic-soda process of desulfurization of waste gases. Many years of observation of seasonal variations of the process parameters at the Zhdanov coal-tar chemical plant where the ambient temperature may drop to 3 C in winter and rise to 40 C in summer suggested the possibility of their close correlation. This surmise was confirmed by the results of two series of concurrent parallel plant tests. In both series, samples of uncleaned coke gas were taken directly from the flue through a branched pipe fastened to a single tap hole and the H2S-concentrations, in gram/cu m, in the purified gas in either branch were measured. In one series, gas in one of the branches was pre-cooled to 10 to 15 C, while that in the other branch was pre-heated to 40 to 50 C before entering the respective jars filled with identical arsenic-soda absorbent solutions of the same temperature. In the other series, gas of the same temperature in both branches was passed through the respective absorbent solutions kept at the temperature of 35 and 52 C, respectively. The H2S-concentrations in the purified gas measured in the first series (given in the form of ordered pairs (pre-cooled, pre-heated)) were: (2.42, 1.23) (7.90, 4.82) (3.32, 1.60) (3.68, 3.20) (5.58, 2.47) (4.84, 2.03) (2.51, 1.47) (3.26, 3.02), and in the second series: (9.37, 3.61) (3.32, 0.96) (3.14, 0.86) (3.10, 1.16) (2.87, 1.07) (2.65, 2.04). These results showed that in every case the coefficient of H2S absorption increases with the operating temperature of the absorption process. After the temperature of the absorbent solution of the arsenic-soda desulfurizer of the Zhdanov plant had been raised from 40 to 50 C, this not only intensified the elimination of H2S and the regeneration of the saturated absorbent, but also insured the stability of that solution when its As2O3-content is high, lessend the deletorious effect on that solution of organic compounds such as benzene, naphthalene, resins, or absorbent oil remaining in the gas after the preceding stage of purification and lowerd the Na2CO3 consumption while making it more uniform throughout the year.

6327 APTIC NUMBER 15994

Boswell, Maitland C.
PROCESS FOR SEPARATING SULPHUR DIOXIDE FROM GASEOUS MIXTURES. (Assignee not given.) U. S. Pat. 1,972,074. 3p., Sept. 4, 1934. (Appl. Sept. 8, 1930, 1 claim).

A method for separating sulfur dioxide from gaseous mixtures when present in small quantities is described. The gaseous sulfur dioxide mixture is brought into contact with a mixture of quinoline and water and a diluent medium miscible with quinoline sulfite. The sulfur dioxide actually combines with the reagent but can be readily dissociated by heating. Pyridine, isoquinoline, and acridine series and their hydrogenation products can also be used as bases. Quinoline is preferred because of higher efficiency and lower cost. The process can be used in either towers or scrubbers.

6328 APTIC NUMBER 15999

Bottoms, Robert Roger
PROCESS FOR SEPARATING ACIDIC GASES. (Girdler Corp., Louisville, Ky.) U. S. Pat. 1,834,016. 5p., Dec. 1, 1931. (Appl. Oct. 15, 1930, 7 claims).

A process for the separation of acidic gases from other gases by the use of an absorbent is described. A gas mixture containing hydrogen sulfide, carbon dioxide, or sulfur dioxide, is brought into contact with a liquid or gaseous absorbent. The absorbent is usually a phenylhydrazine or a hydrazine hydroxide. The solution is heated to free the absorbed gases and the absorbent can be recycled.

6329 APTIC NUMBER 16712

Bretscher, Dr. Hans
ELIMINATION OF MALODOROUS EMISSIONS IN THE CHEMICAL INDUSTRY. Chem. Engr. (London), 221:CE268-270, Sept. 1968.

Many chemical processes are accompanied by the emission of odorous substances, which may have unpleasant effects even when present in concentrations of less than 0.001 mg/N cu m. Odors are particularly difficult to deal with because: They are subjective in nature; satisfactory measurement methods are not available; and meteorological conditions affect the response to odors. As a general principle, elimination of odors at the source is the preferred method of dealing with them. A number of waste gas purification methods which are available are listed.

6330 APTIC NUMBER 16508

Brubacker, M. L.
LITERATURE SURVEY. TECHNOLOGICAL FEASIBILITY OF THE CONTROL OF OXIDES OF NITROGEN EMISSIONS FROM GASOLINE ENGINES. APPENDIX 4. Preprint, California Air Resources Board, Los Angeles, 16p., Feb. 1969. 13 refs.

The amount of nitrogen oxides resulting from the combustion process of fuels depends on the concentrations of oxygen and nitrogen and

on the temperature at which the combustion takes place. Nitrogen oxide emissions increase when the air/fuel ratio is at 14.6, and when the compression ratio is increased. Cruise conditions and part-throttle accelerations contribute to nearly all nitrogen oxide emissions. The retardation of spark timing reduce nitrogen oxide emissions but adversely affect fuel economy and driveability. Exhaust gas recycling receives the most attention as a control method, but also adversely affects driveability. Water injection is effective, but requires the installation of a water tank approximately the same size as the fuel tank. Exhaust manifold reactor with recycling reduces emissions, but again driveability problems are encountered. Over 80% reduction of NO and a life of 350 hours were achieved with cobalt-alumina catalysts. But approximately 1.5% carbon monoxide in the exhaust is necessary to supply the reducing agent. This requires a rich setting of the carburetor, which lowers fuel economy. An approach which has not received much attention is lean operation of the engine. Nitrogen oxides decrease rapidly above 17 air/fuel ratio. Hydrocarbons and carbon monoxide remain low above 17 air/fuel ratio as long as misfires are avoided. Attempts to operate engines leaner than 17 air/fuel ratio in the past resulted in severe driveability problems due to momentary leanness during transient conditions causing misfires. However, this is mainly a problem of delivering a homogeneous mixture of air and fuel to the cylinders under transient conditions.

6331 APTIC NUMBER 16486

Carter, J. W.
ADSORPTION PROCESSES. Chem. Process Eng., 47(8):37-40, Aug. 1966. 30 refs.

The fundamental principles of adsorption by molecular sieves for the preparation of high-purity materials are discussed. The concept of 'mass transfer zone' has been utilized in the design of adsorbers. Both adiabatic and isothermal adsorption are surveyed. The application of adsorption techniques provides pure hydrocarbon feedstocks free from sulfur compounds, water, and carbon dioxide. The physical features of useful adsorbents such as activated alumina, silica gel and activated charcoal are characterized. The amount of adsorbate an adsorbant material will take up at equilibrium is important in determining the maximum capacity of adsorption equipment. A simple circuit of a fixed adsorber bed, the most widely-used form of adsorption plant, is shown and discussed.

6332 APTIC NUMBER 16329

Chartrand, G. and C. M. Crowe
THE OPTIMIZATION OF THE CATALYTIC OXIDATION OF SULPHUR DIOXIDE IN A MULTI-BED ADIABATIC REACTOR. Can. J. Chem. Eng., 47(3):296-301, June 1969. 21 refs.

A multi-bed adiabatic reactor for the catalytic oxidation of sulfur dioxide was optimized using maximum conversion as the criterion and also plant data. Different combinations of the following parameters were varied: number of beds, inlet temperature to each bed, bed depth, and air dilution before each bed. The optimization techniques used and compared for efficiency were dynamic programming, gradient search, Hooke and Jeeves' pattern search, and the discrete maximum principle. The most useful method found for optimization was Hooke and Jeeves' pattern search. The discrete maximum principle was the fastest method and did find the optimum, but did not show the contours near the optimum. The optimum conversion, or very close to it, was achieved with a range of inlet temperatures to the first bed, a range of catalyst distributions and a range of air addition rates to the beds. The imposition of the temperature constraint of less than 600 C reduces the optimum conversion by only 0.02% but greatly reduces the range of feasible inlet temperatures to the first bed. Although it was not directly studied, the temperature constraint would also reduce the feasible range in catalyst distribution since the temperature out of bed 1 exceeded 600 C in most cases calculated. To within the accuracy of the assumptions of the model, the conversion of the plant studied could be increased by 0.25% to 97.84% by altering the temperatures and catalyst distribution. Whatever the catalyst distribution and the temperature to the first bed, the temperatures into the third and fourth beds were always very close to 452 and 440 C, respectively.

6333 APTIC NUMBER 16525

Chase, Frank W.
DUST COLLECTION PAYS ITS WAY. Am. Machinist, 114(2):114-118, Jan. 26, 1970

Unless a dust-generating device is closely followed by a dust-collecting device, a serious health hazard exists. This is particularly true with some of the toxic materials, such as beryllium and silica compounds, and silicosis is a respiratory ailment long associated with prolonged inhalation of irritating dusts. Compliance with local pollution control laws is another reason for considering dust-collection equipment. Finally, dust collectors are frequently needed not to get rid of the dust, but to save it, such as plants working with precious metals. Their salvage value more than offsets the cost of collection. Essentially, a metalworking plant is faced with three types of metal waste: chips, dust particles, and loaded lint. In general, two types of dust collectors are in general use: the cyclone type and the fabric-filter type. The cyclone separator is designed for chips or larger particles. The fabric filter type is used for fine particles. The term 'fractional efficiency' is defined. The advantages and disadvantages of dust collectors and a comparative specifications in choosing a dust collector are charted. Several case histories of metalworking installations where a personnel or production problem was solved or alleviated through the use of a dust collector are given.

6334 APTIC NUMBER 16053

HI-PURITY LIQUID SO2 FROM ROASTER GASES. Chem. Eng., 60(4):274-277, April 1953.

Liquid sulfur dioxide of 99.9975% purity can be manufactured on a commercial scale by the absorption-desorption process using by-product roaster gases as the sulfur dioxide source and

dimethylaniline (DMA) as the absorption medium. The process utilizes chemical and antimonial lead as the chief materials of chemical construction. Lead is used because of its excellent resistance to the corrosive characteristics of sulfur dioxide in combination with DMA. Sulfur dioxide from the roasting gases is conveyed to the sulfur dioxide plant and cleaned. The gas then enters an absorbing tower consisting of a series of bubble caps which force the gas into intimate contact with DMA. The quantity of gas that is dissolved in DMA depends upon the temperature, the cooler the liquid, the greater the quantity of gas dissolved. During absorption, the temperature of DMA liquid increases and it must be cooled at intervals by recirculation through a water-cooled lead pipe coil situated outside the tower. The DMA saturated with sulfur dioxide is passed through heat exchanger coils where it is preheated on its way to the stripping tower. In the stripping tower, it is heated with indirect steam heat and denuded of its sulfur dioxide content. The heated, stripped DMA liquid leaving the stripping tower passes back through the heat exchanger, where it is cooled before reentering the absorbing tower. The sulfur dioxide from the stripping tower passes through a third bubble cap tower where concentrated sulfuric acid reduces its water content to less than 25 ppm. The pure gas passes to a compressor where it is liquified under pressure and stored in a large steel tank.

6335 APTIC NUMBER 16713

TOUGH AIR-POLLUTION LAWS STIMULATE DESIGN TWISTS. Chem. Eng., 76(2):84-86, Jan. 27, 1969.

In an effort to reduce the amount of pollutants released to the atmosphere, engineers are developing equipment that is often novel, simple, and economical. Some modifications of old equipment and some unique approaches to emission problems are discussed briefly.

6336 APTIC NUMBER 16708

SYSTEM TRAPS 90-95% OF POLLUTANTS. VOLATILIZED PLASTICIZERS RECOVERED FOR REUSE IN PROCESS. Chem. Process. (Chicago), 32(2): 74, Feb. 1969.

A system for control of air pollution and recovery of volatiles from vinyl curing oven stack emissions is described. The system, which consists of a condensation chamber and a mist eliminator, can remove and recover up to 95% of volatilized organics from oven gas, and can completely eliminate the plume.

6337 APTIC NUMBER 15964

IMPROVEMENTS RELATING TO THE WASHING AND COOLING OF GASES CONTAINING SULPHUR DIOXIDE. (Chemiebau Dr. A. Zieren GmbH, Niedermarsberg, Germany) British Pat. 744,465. 3p., Feb. 8, 1956. (Appl. April 9, 1952, 6 claims).

A two-stage washing and cooling process for roasting and combustion gases which contain sulfur dioxide is described. The gases are treated with a washing liquid, in a separate cycle for each stage to obtain purified sulfur dioxide. In the first stage, either the entire portion of the washing liquid or a fraction of it is also subjected to a cooling operation. The heat from the washing liquid is converted into latent heat of evaporation. In successive stages, the heat is indirectly removed from the washing liquid by the use of cooling surfaces.

6338 APTIC NUMBER 15947

Chertkov, B. A.
DISSOLVING OF SO2 IN THE PROCESS OF WATER WASHING OF FLUE GASES. (Rastvoreniye SO2 v protsesse vodnoy promyvki dymovykh gazov). Text in Russian. Teploenergetika, 4(12):61-65, 1957. 8 refs.

Generalizations are established related to the dissolving of sulfur dioxide in water which use available data for packed scrubbers which serve to cool flue gases and to remove aerosols. Data used cover water temperatures from 20-50 C, with SO2 partial pressures ranging from 1.60-4.20 mm Hg. Because of variables due to the presence of free alkali in the fuel burned, each situation must be dealt with experimentally. In the case of SO2 absorbed by the return water in a scrubber-cooling tower system, water acidity by the phenothalene test is 6-7 times higher than in an open scrubber irrigation system, while the ash content is 20-40 times higher.

6339 APTIC NUMBER 16187

Chikira, Hiroo
EXHAUST GAS CLEANER. (Haikigasu seijosochi). Text in Japanese. (Assignee not given.) Japanese Pat. Sho44-22566. 3p., Sept. 26, 1969. 2 refs. (Appl. May 13, 1966).

An insulated chamber is located behind an engine manifold. The interior of the chamber is kept at around 1000 C and provided with air. Exhaust gas components such as carbon monoxide or hydrocarbons are instantly burnt away. The device of the present invention comprises a combustion chamber, a heat insulator, a preheater, and a stirrer. The cylindrical combustion chamber is composed of heat-resistant material. The heat insulator, which consists of layers of reflecting insulators, surrounds the combustion chamber. The preheater houses the heat insulator. Air is first heated in the preheater before entering the combustion chamber. Inside the combustion chamber, a stirrer is provided to mix the exhaust gas with the air. Since carbon monoxide oxidizes at 600-660 C, and hydrocarbons at 680-800 C, the chamber temperature is high enough. The merits of the invention are that no catalysts are used and that the chamber is compact enough to be installed in narrow spaces near the engine. There is no loss in engine power.

6340 APTIC NUMBER 15876

Clark, Arthur Maurice, William Edward Batten, and Charles Frederick Reed Harrison

RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES. (Imperial Chemical Industries, Ltd., Great Britain) U. S. Pat. 2,173,877. 6p., Sept. 26, 1939. (Appl. Oct. 10, 1935, 25 claims).

A cyclic regenerative absorption process is described for the recovery of sulfur dioxide from gases containing small concentrations of sulfur dioxide, e.g., gases derived from the roasting of sulfide ores. The SO2-containing gas is scrubbed with an aqueous solution of basic aluminum sulfate in which the SO3 to Al. 3 ratio is maintained at about 35-50%. The stability of the solution is such that precipitation of basic aluminum sulfate is likely to occur at temperatures above 80 C. The SO2-charged solution is passed through a heat exchanger where it comes into contact with a hot regenerated absorbent solution. This heats the SO2-charged solution and drives off sulfur dioxide. The resulting regenerated solution is rapidly cooled to a temperature of 80 C and returned through the heat exchanger to heat more SO2-charged solutions. Basicity of the aluminum sulfate solution can be maintained by adding calcium carbonate or metallic aluminum to the solution.

6341 APTIC NUMBER 16190

Clark, Arthur Maurice
RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES. (Imperial Chemical Industries Ltd., Great Britain) U. S. Pat. 2,128,027. 5p., Aug. 23, 1938. (Appl. April 14, 1938, 10 claims).

A cyclic process for the recovery of sulfur dioxide from gases with a liquid absorbent was invented. The gas is brought into contact with the absorbent. The absorbent consists of a water-insoluble liquid organic base such as aniline, quinoline, or xylidine and an aqueous medium consisting of a neutral sulfate such as sodium, potassium, or ammonium sulfate. Sulfur dioxide is then removed from the absorbent. The neutral sulfate and organic base which form separate liquid phases are separated. Part of the aqueous medium is treated with dissolved sulfur dioxide and a neutral sulfate with a calcium compound which is selected from calcium oxide, calcium hydroxide, calcium carbonate, or calcium sulfite. Calcium sulfate is precipitated out of the mixture. It is then used in a mixture with an organic base and any untreated aqueous medium for absorbing more sulfur dioxide from gases.

6342 APTIC NUMBER 16020

Clarke, P. J., J. E. Gerrard, C. W. Skarstrom, J. Vardi, and D. T. Wade
AN ADSORPTION-REGENERATION APPROACH TO THE PROBLEM OF EVAPORATIVE CONTROL. Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1967. 5 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 9-13, 1967, Paper 670128.)

A device for preventing evaporative emissions of hydrocarbon fuel from automotive vehicles is based on a controlled adsorption-desorption cycling in a solid adsorbent system using activated carbon. The system is capable of containing all types of evaporative emissions: carburetor and tank running losses, carburetor hot soak losses, and tank diurnal cycle losses. The three essential components of the system are the canister of adsorbent, the pressure balance valve, and the purge control valve. The canister traps the vapors before they can escape to the atmosphere and holds them until they can be fed back to the engine. The pressure balance valve maintains metering forces in the carburetor exactly as originally designed. When the engine is shut down, the valve closes all external vents and routes vapors from the carburetor exactly as originally designed. When the engine is shut down, the valve closes all external vents and routes vapors from the carburetor bowl to the canister. The function of the purge control is program stripping of the canister and consequent feeding of the hydrocarbon-laden, purge air stream to the intake manifold. Evaporative emissions from cars on which prototype devices were installed were measured according to proposed California standards for carburetor losses per hot soak and for fuel tanks. All data fell within a range of 0.3 to 109 grams, well below the proposed gram losses.

6343 APTIC NUMBER 15779

Collins, Theron T., Jr.
ODOR CONTROL AND HEAT RECOVERY IN WOOD PULPING PROCESS. (Assignee not given.) U. S. Pat. 3,183,145. 9p., May 11, 1965. 6 refs. (Appl. June 22, 1962, 10 claims).

Methods are described for controlling the pollution of the atmosphere and bodies of water in the vicinity of wood pulping mills. The method is described in terms of the wood pulping process; however, it may readily be adapted for use with other wood pulping processes that exit waste condensates which contain such odorous and noxious gases as methyl mercaptan and hydrogen sulfide, as well as hot water vapor laden gases which contain sulfur dioxide. The gases are passed into contact with black liquor prior to the concentration, thus oxidizing the liquor. For example, sulfur dioxide containing gases derived from the lime kiln and/or the recovery furnace are contacted with one or more of the condensates containing the sulfur compounds as hydrogen sulfide and methyl mercaptan, under conditions which cause condensation of at least a portio of the water vapor in the hot gases. A portion of the sulfur dioxide content of the hot gases reacts with a portion of the hydrogen sulfide and/or methyl mercaptan content of the condensates to render the undersirable odor producing compounds innocuous. Simultaneously, the alkaline components of the condensates are carbonated and the condensates are stripped of substantial portions of the unreacted sulfur compounds. The effluent gases are then oxidized, preferably using active chlorine containing bleach plant wastes, to oxidize the remaining odor producing materials in the gases. The condensates are cooled so as to recover a portion of their heat content and to simultaneously render the residual unstripped gases more soluble.

6344 APTIC NUMBER 13896

Confer, D. S., D. W. Kestner, Jr., and H. B. Charmbury
THE PREPARATION CHARACTERISTICS OF THE BITUMINOUS COAL RESERVES

IN PENNSYLVANIA WITH SPECIAL EMPHASIS ON SULFUR REDUCTION. Pennsylvania State Univ., University Park, Dept. of Mineral Preparation, Contract CR-29, Rept. SR-35, 108p., Oct. 31, 1962. 14 refs.

Because much of the high-quality bituminous coal of Pennsylvania has been depleted, lower-grade coal, which has high ash and sulfur content, is being mined. A field survey of the sulfur reduction operations currently being used by 103 coal preparation plants in central and western Pennsylvania was conducted by the Department of Mineral Preparation, The Pennsylvania State University. The data obtained were compared with those compiled by the U. S. Bureau of Mines. The Bureau had collected large face and tipple samples from various locations, and it had conducted washability studies on run-of-mine samples which were crushed to top sizes of 1-1/2 in., 3/8 in., and 14 mesh. The washability studies showed the clean coal recovery and grade theoretically possible as well as the effect of fine crushing on the liberation of ash and sulfur. The data collected by both surveys was tabulated as to district, county, seam, screen size, and sulfur content of the theoretical and/or actual clean coals. Where data was available, a cleaning point of 10% + or - 0.1% near gravity material was selected as the cleaning point for the theoretical clean coals.

6345 APTIC NUMBER 16502

Cooper, D. B.
LOW EXCESS AIR FIRING LOWERS HEAT RATE AT LARGE UTILITY. Combustion, vol. 36:28-34, Aug. 1964.

By firing two boilers (each rated at 1,200,000 lb/hr steam flow at 1850 psig, 100 F superheat, and 100 F reheat) on 2-2 1/2% excess air with oil fuel, a steam plant obtained an average reduction in net heat of 60 Btu/kwh, with a yearly saving in fuel of $19,350. Nitrogen oxides were reduced from 621 ppm on normal excess O2 to 452 ppm on low excess O2, a reduction of 27%. The amount of fly ash collected on low air excess firing is relatively small, amounting to about 0.15% by weight of the fuel fired. Under excess firing conditions, as much as 300 lb of ash per day per unit were collected. There is also an unmeasurable but evident reduction in sulfur trioxide as the result of low excess air firing.

6346 APTIC NUMBER 16418

Cortelyou, C. G.
COMMERCIAL PROCESSES FOR SO2 REMOVAL. Chem. Eng. Progr., 65(9): 69-77, Sept. 1969. 5 refs.

Projections of the amount of sulfur oxides emitted from major sources for ten year intervals from 1970 - 2000 are presented. Four stack gas sulfur removal processes are given economic and technical evaluation: dry dolomite injection with wet scrubbing, catalytic oxidation, the alkalized alumina process, and the Reinluft dry char absorption process. These methods will find their widest application among large combustion units, such as power generating stations; in general, they will not be applied to existing facilities. Cost considerations indicate that the processes will utilize the highest sulfur content fuel available. The eventual choice of processes will be guided by stage of technical development, storage, transport, and marketing costs associated with each type of by-product. (Author summary modified)

6347 APTIC NUMBER 16279

Curran, George P., Carl E. Fink, and E Gorin
BENCH SCALE RESEARCH ON CSG PROCESS. OPERATION OF THE BENCH SCALE CONTINUOUS GASIFICATION UNIT. PHASE II. (INTERIM REPORT). Consolidation Coal Co., Library, Pa., Research Div., Office of Coal Research, Contract 14-01-0001-415, R and D Rept. 16, 233p., 1968. 11 refs.
CFSTI: PB184720

The salient features of the carbon dioxide acceptor process were studied and the feasibility of the process determined in a pre-pilot continuous prototype unit. The unit was designed to study the operation of a two-vessel system with a simultaneous operation of one vessel as a regenerator and the other as either a hydrodevolatilizer or a gasifier. Sub-bituminous coals and lignite or lignite chars were used in the study. A number of dolomites and limestones and a synthetic 'melt' type of acceptor were also tested. The study demonstrates in particular the feasibility of handling a dual fluo-solids system with the acceptor continuously showering through and segregating at the bottom of a fluidized char under full process conditions of temperature and pressure. Both dolomites and limestones were found to maintain the equilibrium activity required to absorb carbon dioxide. Acceptor conglomeration was not a problem in the fluidized bed. However, serious operating problems were found with western sub-bituminous coals due to deposit formation in the regenerator and bulk ash fusion. Excessive particle swelling and some coking was experienced when these coals were processed directly in the devolatilizer. Light preoxidation of the coal at 500 F prevented coking. Coking was not a problem in the direct hydrodevolatilization of lignites, but particle swelling occurred and resulted in a low density char. Lignite preoxidation is suggested to increase the char particle density. Lignites are sufficiently reactive to permit operation of the gasifier at 1500 F and a total system pressure of 11 atm. With less reactive sub-bituminous chars, a gasification temperature 50 F higher is needed to achieve gasification rates comparable with those of lignite. To achieve adequate CO2 absorption, the system pressure must be 20 atm. A correlation of the experimental data is presented which can be used to predict equilibrium acceptor activity as a function of acceptor make-up rate and operation temperatures in the gasifier and regenerator. The sulfur cycle is discussed with respect to sulfur pick-up in the gasifier and devolatilizer, sulfur rejection in the regenerator, and reactions of fuel char sulfur in the regenerator.

6348 APTIC NUMBER 15774

de Jahn, Fredrik W.
METHOD FOR RECOVERING IN CONCENTRATED FORM GAS EXISTING IN DILUTE ADMIXTURE WITH OTHER GASES. (Jacob D. Jenssen, New York City)

U. S. Pat. 1,946,489. 5p., Feb. 13, 1934. (Appl. May 17, 1932, 12 claims).

A method is described for extracting gases and vapors from mixtures where the gas or vapor to be extracted is present in low concentrations. The method involves absorbing the component of the gas mixture to be concentrated in a suitable solvent, such as a cold aqueous medium in the case of sulfur dioxide, then withdrawing the dissolved gas from the solvent by means of a second solvent which is immiscible with the first and has a selectively preferential solvent affinity for the gas, and expelling the gas from the second solvent, thus recovering it as 100% gas. Thus, two separate liquid circuits are established which meet at a point where the first solvent transfers its dissolved gas to the second; the first solvent is recirculated to pick up additional quantities of gas, while the second circuit passes through stages where the gas is recovered by heating. The second solvent is refrigerated and returned to contact with the first solvent. Examples are given for the extraction of sulfur dioxide.

6349 APTIC NUMBER 16028

Deal, Carl H., Jr. and Michael H. Papadopoulos
METHOD OF REMOVING SULFUR CONTAINING GASES FROM GASEOUS MIXTURES AND RECOVERING SULFUR THEREFROM. (Shell Oil Co., New York) U. S. Pat. 3,363,989. 7p., Jan. 16, 1968. 6 refs. (Appl. Nov. 4, 1965, 9 claims).

An invention is described which separates sulfur-containing acidic gases (particularly hydrogen sulfide) from gaseous mixtures by selective absorptio combined with a device for converting the sulfur-containing gases to sulfur in the same medium. Three processes are described. The first is the absorption of H2S from a sour gaseous feed. Part of the H2S is oxidized to SO2 which is then combined with the remaining H2S in the presence of the absorption gas conversion medium for conversion to sulfur. The lean solvent is thus regenerated and recycled to thyinitial absorption step. The absorption conversion medium is composed of a sulfone, water, a ferrous salt, and a pyridine carboxylic acid. A second aspect comprises the injection of the sour gaseous feed containing H2S into the presence of the absorption conversion medium containing SO2. The sulfur is withdrawn and part is oxidized back to SO2 and recycled back to the reactor section in the presence of the absorption-conversion medium. The third process comprises absorbing H2S from the sour gaseous feed and utilizing the absorption-conversion medium. SO2 is injected into the fat solvent to form sulfur. Part of the sulfur is oxidized to SO2 which is absorbed in the absorption-conversion medium. The SO2-medium is then recycled back to the sulfur reactor.

6350 APTIC NUMBER 15982

Dekhtyarev, A. P.
PROTECTION OF THE AIR BASIN OF CITIES FROM INDUSTRIAL DISCHARGES. (Zashchita vozdushnogo basseyna gorodov ot promyshlennykh vybrosov). Text in Russian. In: Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov. Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p. 51-56.

Results from pollution studies in large cities in the Ukrainian SSR are examined. A general reduction, since 1960, in dust and soot content has been accompanied by an increase in sulfur dioxide. The operation of cyclone scrubbers, electrofilters and high-temperature afterburners is described in general terms. Dimensions and capacities of a number of electrofilter types are tabulated. Capacities range from 95 to 460 thousand cubic meters per hour. The high cost and inadequacies of chimneys is discussed. Mention is made of supersonic ejectors for propelling pollutants to a height of 800 meters.

6351 APTIC NUMBER 16496

Denes, S., L. Farkas, and Gy. Varju
HOT-LINE INSULATOR WASHING AS AN EFFECTIVE MEANS OF COMBATTING HEAVY POLLUTION. Preprint, 6p., 3 refs. (Presented at the Conference Internationale des Grands Reseaux Electriques, 22nd, Paris, June 10-20, 1968.)

In the area of thermal power stations fired by a high ash-content, low-grade coal, the pollution of insulators can cause flashovers that jeopardize the continuous operation of outdoor switching stations. At a Hungarian power station, this problem was minimized by the development of a mobile insulator washing unit provided with a water nozzle delivering a single continuous water jet. The components of the unit are assembled on a rubber-tire carriage easily moved by two operators. Protection against electric shock is provided by an automatically controlled valve for shutting off the water supply to the nozzle. All 120 kV insulators of the substation are washed in three and one-half hours without interference to the normal service of the high-voltage equipment. Neither the conductivity of the river water used for washing nor the amount of suspended matter contained in the water have influenced washing operations. Moreover, satisfactory results have been obtained under extreme weather conditions. A comparison with silicone-grease treatments and stationary washing units shows that the method is more reliable and less expensive.

6352 APTIC NUMBER 16062

Donkelaar Van, A.
AIR QUALITY CONTROL IN A BLEACHED KRAFT MILL. Can. Pulp Paper Assn., Tech. Sec., p. T346-T350, 1967 (?). 10 refs. (Presented at Paper Ind. Air and Stream Improvement Conf., 3rd, Vancouver, B. C., 1967.)

The air pollution control program of a bleached kraft mill in northern Calif. is described. By using black liquor oxidation, hydrogen sulfide emissions from the stack were reduced to near zero, and a high degree of efficiency in eliminating mercaptans and organic sulfides was reached through treatment by incineration. A detailed in-plant monitoring program for measuring emissions is described and the results reported weekly to the local Air

Pollution Control District. The use of telephone responses and home monitoring systems are also valuable. Four-hour checks on critical equipment, weather measurements, and an ambient air monitoring program in which particulate fall-out is measured at seven stations, are also part of the control program. Data show typical main stack emissions, lime kiln stack emissions, and green liquor dissolver stack emissions.

6353 APTIC NUMBER 15806

Douglas, Harold E., Ivan W. Snider, and G. H. Tomlinson, II
THE TURBULENT CONTACT ABSORBER. Chem. Eng. Progr., 59(12):85-89, Dec. 1963. 5 refs.

The turbulent contact absorber is a gas-liquid contacting tower developed for gas absorption and heat transfer operations, characterized by the use of an essentially non-flooding packing consisting of low density spheres placed between retaining grids sufficiently far apart to permit turbulent and random motion of the spheres. Pilot studies are described involving the absorption rate of carbon dioxide in an alkaline process liquor; sulfur dioxide in sodium hydroxide to give a sodium bisulfite liquor; sulfur dioxide in magnesium hydroxide slurry to give a magnesium bisulfite liquor; and heat transfer rates. Initial flow studies indicated that when the static volume of packing exceeded 50% of the absorption zone, the spheres tended to move as a bed characteristic of the floating bed type of operation; a marked decrease occurred in gas flow at sharply increased pressure drop. The high vapor and liquid rates possible with the turbulent contact absorber permit operation with appreciable liquid loading in the absorption zone. Absorption takes place not only on the wetted surface of the spheres but also throughout the whole active zone. The high rate of intimate mixing tends to minimize any effect of the relatively slow diffusion rates normally encountered in packed towers. The high gas and liquid rates not only allow the use of small diameter towers, but, because of high mass and heat transfer rates, allow the use of relatively short tower heights for any given job.

6354 APTIC NUMBER 15962

Doumani, Thomas F.
PROCESS FOR THE SEPARATION OF SULPHUR DIOXIDE FROM GASES. (Union Oil Co. of California, Los Angeles) U. S. Pat. 2,370,020. 4p., Feb. 20, 1945. (Appl. Aug. 16, 1941, 3 claims).

A method is described for recovering sulfur dioxide from sulfur-containing gases produced by the catalytic treatment of petroleum fractions, the burning of sulfite ores in smelting operations, the burning of high sulfur coals, etc. The method comprises contacting the gas with an aqueous solution of nitrogen base and heating the resulting mixture to liberate the sulfur dioxide. The nitrogen bases, which are obtained from petroleum, coal tar, bone oil or their mixtures without previous purification or, are mixed with water and the mixture is conducted to an absorption tower. When dissociated from sulfurous acid by heating, the bases separate as an oil less dense than the aqueous layer. These dissociated bases are used in subsequent cyclic and regeneration processes. Depending on gas and liquid flow rates, the process reduces gases containing 5-10% sulfur dioxide to less than one-tenth sulfur dioxide.

6355 APTIC NUMBER 16427

Downer, Whit
AMMONIA ABSORPTION: REFRIGERATION SELECTED FOR GASOLINE PLANT. Refining Eng., vol. 29:C25 to C30, July 1957. 1 ref.

A 200-ton capacity ammonia absorption refrigeration unit at a gas processing plant chills incoming gas to 0 F for the separation of gas liquids. The only moving component in the system is an ammonia liquor pump: widely varying loads are automatically handled with no mechanical adjustments required. Power requirements are directly proportional to the refrigeration load. Liquid recovery, based on the total available in the incoming gas stream, is propane, 19%; butanes, 47%; and 14 RVP natural gasoline, 95%. This corresponds to a total liquid recovery of 25,800 gal per day, including 8600 of propane, 7500 of butanes, and 9569 of natural gasolines. The operation of the ammonia refrigeration system, low temperature gas separator, and ammonia fractionator is given in detail. Advantages of the absorption refrigeration system are its low costs and operating flexibility. Though taking up more room that a compression plant, the absorption unit is constructed entirely out-of-doors: no buildings are needed to protect the equipment. In small size ranges, the initial costs of absorption systems are relatively high, varying from $700 to $1500 per ton of refrigeration. In contrast, initial costs for units over 100 tons are less than $400 per ton.

6356 APTIC NUMBER 15849

Dunn, John Stanley
IMPROVED PROCESS FOR THE RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES CONTAINING IT. (Imperial Chemical Industries Ltd., London, England) British Pat. 371,888. 3p., April 29, 1932. (Appl. Jan. 29, 1931, 4 claims).

Essentially pure sulfur dioxide can be recovered from gases by washing vapor-free gases in substantially anhydrous solvent consisting of one or more of the following: aniline, its homologues, and N-alkyl derivatives of aniline and their homologues. Washing is carried out in a counter-current packed tower under about 10 atm and at low temperature. The absorbed gas is freed by the application of heat or by reduction of pressure. Traces of solvent in the recovered gas are removed by passing the gas over activated charcoal.

6357 APTIC NUMBER 15886

Eberhardt, J. E. and H. S. Graham
THE VENTURI WASHER FOR BLAST FURNACE GAS. Iron Steel Engr., 32(3):66-71, March 1965. 11 refs.

Data are presented for a pilot plant venturi blast-furnace gas washer with a nominal capacity of 25,000 cfm and a plant scale venturi with a nominal capacity of 85,000, as installed in a steel co. Data for the 18-in. pilot unit indicate that the dirt content of the cleaned gas depends on the gas pressure loss across the venturi section; the gas pressure loss on the gas flow rate and the water ratio (gas of water per thousand cu ft of gas). Correlations are presented for pressure drop vs dust loading and for pressure drop vs water ratio at seven gas flow rates. The dust loading of the cleaned gas varies from 0.09 gr/cu ft at a pressure loss of 7 in. of water to 0.015 gr/cu ft at a pressure loss of 24 in. of water. The thickener capacity required for this washer is only 3-5 gal per thousand cu ft rather than the 20 gal per thousand cu ft used in conventional washers. The plant scale washer is generally similar to the pilot plant; but the throat section is rectangular rather than circular, and the cooling tower contains no packing. The gas flow rate is close to 76,000 cfm and the water flow to about 11 gal per thousand cu ft. Pressure loss in this unit depends on factors other than gas velocity and water ratio, although pressure loss is increased by increasing either gas velocity or water ratio. Good cleaning is obtained with a water consumption of about 5 gal per thousand cu ft of gas.

6358 APTIC NUMBER 16351

Eisenbarth, Manfred
DUST REMOVAL FROM WASTE GASES IN A STEEL PLANT. (La depolverizzazione dei gas di scarico delle acciaierie). Text in Italian. Riv. Ing., 10(10):720-729, Oct. 1969.

Four areas of the steel plant most responsible for the production of dust-laden air are discussed: convertors, electric arc furnaces, electric reduction furnaces, and flame-hardeners. Dust removal is analyzed in three stages: aspiration, cooling, and purification. A cooling stage is necessary, since the waste gases measured at the bottom of the convertor are formed at a temperature of 500-1100 C, whereas mechanical filters require temperatures between 200 and 270 C and electric filters operate best at 150 - 180 C. Cooling can be effected by running the gases through a long length of tubing; absorbing the heat with refractory bricks in a large reservoir (bricks are cooled with cold air between batches); and by spraying atomized liquid under pressure into a tower containing the gas, so that the evaporating liquid will absorb heat of vaporization from the gas mixture. Four possibilities exist for purification: dry purification with mechanical filter; dry purification with electric filters; wet purification with electric filters; and wet purification with scrubbers. Two wet-press scrubbers are described in detail: the venturi system and the OG process developed by Demag. The various systems and combinations thereof are examined in terms of cost, space requirements, compatability with special conditions, and possible uses for by-products.

6359 APTIC NUMBER 16173

PILOT PLANT ABSORBS SULFUR IN STATION STACK GASES. Elec. World, 168(15):29-30, Oct. 9, 1967.

A pilot unit for the chemical absorption of SO2 and SO3 was tested for several months in a power plant and was found to remove more than 90% of sulfur in stack gases and all the fly ash that remained after gases passed the precipitator. Flue gas is passed through a reactor which removes both SO3 and fly ash. From the reactor the flow goes to a receiving tank and then to a special treatment tank. Part of the solution, minus the SO2, SO3, and fly ash, is returned from the treatment tank to the reactor from which clean air is discharged to the stack. The remainder of the solution, which contains the SO2 removed from the stack gases, is pumped to a cooler and stripping column. SO2 vapor passes from the column to a compressor. The solution is pumped from the stripping column back to the receiving tank. The recovered SO2 is 99.9% pure and is marketed to sulfuric acid plants or converted to elemental sulfur. Estimated annual operating costs for the SO2 removal system are $2,008,600. Estimated sulfur recovery is 81,000 tons, the sale of which should cover investment and operating costs. Investment costs and operating costs are itemized.

6360 APTIC NUMBER 16129

REMOVE SULFUR DIOXIDE AT A PROFIT? Elec. World, 173(4):28-29, Jan. 26, 1970.

A new chemical method is described for scrubbing sulfur dioxide from power plant stack gases and converting it to rechargeable additives and saleable by-products. An economic analysis of such a system added to an existing 1200 Mw coal-burning station indicated that revenue from the sale of by-products would cover all operating costs, debt service, taxes, and depreciation, as well as about a third of the utility's customary return on equity. The starting point for the process is the absorber tower to which the flue gas is diverted before entering the stack. Here the gas is scrubbed with a sodium hydroxide solution capable of reducing SO2 content to under 50 ppm. The gas is then passed through a booster fan and reheater and discharged to the stack. The effluent, a solution of mixed sulfur salts, is pumped to a stripper tower, where dilute sulfuric acid is added to oxidize all sulfur compounds to Na2SO4 and drive off the surplus SO2. The latter is collected to become feedstock for the manufacture of sulfuric acid, or to be dried and liquified for sale as SO2. The sulfates then pass into a three-section electrolytic cell in the central region between a porous diaphragm and a nonporous membrane. There the ions are separated by electrolysis, the SO4 radial being drawn to the anode where it combines with hydrogen ions as dilute sulfuric acid, while the sodium ions permeate the membrane to join OH radicals at the cathode and form NaOH. Some gaseous hydrogen and oxygen is also produced at the electrodes. All NaOH from the cathode compartment is recyled to the absorber tower; part of the H2SO4 is recycled to the desorption tower. The pure hydrogen given off can be used to reheat stack gases as they leave the absorber, or sold if the market provides a cheaper fuel for the stack-gas reheater. Surplus dilute sulfuric acid and all pure oxygen can be sold as byproducts. The advantage of the process is that it regenerates all of its chemical feed requirements and avoids the difficulty of disposing of useless residues.

6361 APTIC NUMBER 13502

NAPCA CHECKS EMISSIONS OF NEW AUTOS. Environ. Sci. Technol., 3(7):625-627, July 1969.

Before new cars are sold in the United States, manufacturers must assure the Federal Government's certification facility of compliance with emission standards. Automotive vehicle emissions account for an average of 60% of the air pollution burden in this country, ranging as high as 80% in some areas. The Clean Air Act authorizes the Secretary of Health, Education and Welfare to develop standards for the control of motor vehicle emissions. A division of The National Air Pollution Control Administration directs a certification facility responsible for certification of present and future model vehicles, development of test and surveillance procedures, evaluation of advanced technology and collection of surveillance data. Two series of federal standards have been adopted: One for 1968 vehicles and a second for 1970 vehicles. A third series proposed for the 1972 models is expected to be the first true mass emissions standard. The 1972 procedure would measure the actual mass of exhaust emissions because the 1970 procedure for calculating exhaust volume gives values that were found to be about 60% lower than the actual emission control techniques being studied which include exhaust gas recirculation, air injection, exhaust manifold reactors, and a stratified charge engine. Although standards first became effective in 1968, the public will not see any in effect until 1970. The expected decrease in emissions will be short-lived due to an increase in the number of vehicles. Standards have been set only for hydrocarbon and CO emission; they have yet to be applied to other pollutants, such as oxides of nitrogen and lead compounds.

6362 APTIC NUMBER 15952

Error, James Victor, George Wesson Ostberg, and John Lilis Disney
A METHOD FOR DESULFURIZATION OF CRUDE OILS WITH A WIDE RANGE OF BOILING POINT BY HYDROGENATION. (Koffutteuhani genyu o suiten datsuryu suru hoho). Text in Japanese. (Esso Standard Eastern, Inc., New York) Japanese Pat. Sho44-13374. 7p, June 16, 1969. 1 ref. (Appl. May 4, 1962).

The invention relates to the desulfurization of the broad cut portion of crude oil by hydrogenation. The broad cut portion contains naphtha, kerosine, etc as single cuts. The crude oil is heated until all the broad cut part evaporates and is distilled by flash evaporation under the pressure of 30 psi. The vapor is condensed and cooled to a temperature lower than 200 F. After removal of the uncondensed gas, the liquid is heated at 100 to 1000 psi and then at pressures high enough for all contents to evaporate. Hydrogen gas is added, and the broad cut portion desulfurized in the presence of a catalyst such as cobalt molybdate at 500 to 800 F and at 400 to 500 psi. The hydrogen sulfide generated is washed away by an amine solution such as dimethylamine or diethylamine. A narrow boiling point oil is obtained by the fractional distillation at about 60 psi. Application of this method to crude oil containing 1.9% sulfur decreased the sulfur content of kerosine to 0.0004%, and that of light straight naphtha to 0.0002%.

6363 APTIC NUMBER 16591

Faitani, J. J.
SMOKE REDUCTION IN JET ENGINES THROUGH BURNER DESIGN. Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1968. 5 refs. (Presented at the Automotive Engineers Society Air Transportation Meeting, New York, April 29-May 2, 1968, Paper 680348.)

The exhaust composition from jet engine burners was determined and burner design changes were investigated to reduce smoke emissions. The task of modifying a jet engine burner to reduce exhaust smoke leads to many problems that must be resolved before revised burners can be placed into service. The basic technique that offers the most promise for current engines in service is that of leaning out the primary zone to reduce local fuel-rich pockets which are the sources of carbon formation. However, the location of the air entry ports, manner of air injection, and fuel spray quality are critical factors. The exact details of fuel spray characteristics are peculiar to the basic burner involved and it is difficult to establish firm guidelines. High pressure fuel nozzles do not appear to have a strong influence on smoke formation, but this may be dependent on the primary zone airflow patterns and percent air in this region. Significant changes in combustor stability, ignition, carbon deposition, and durability characteristics are also affected by alteration of primary zone fuel and airflow pattern. A premixed or vaporizer burner system offers smoke-free operation and the possibility of obtaining greater heat release rates, thus allowing reductions in burner size. The same techniques of smoke reduction apply to canannular and annular combustion chamber designs. Extensive work was also required to develop smoke measuring systems. A modified Von Brand Filtering Recorder was selected as the standard measuring system.

6364 APTIC NUMBER 13551

Faith, W. L.
AIR POLLUTION ABATEMENT. SURVEY OF CURRENT PRACTICES AND COSTS. Chem Eng. Progr., 55(3):38-43, March 1959. 8 refs.

Pollutants and control methods of the chemical manufacturing, pulping, petroleum refining, steel, food, and cement manufacturing industries are reviewed. Chief pollutants from the chemical industry are dilute vent gases, acid mists, waste sulfides, nitrogen oxides, combustible wastes, and dust. Vent gases are best controlled by catalytic oxidation, sulfides by caustic scrubbers, nitrogen oxides by catalytic reduction, combustible wastes by incineration, and dust by filtration. No standard procedure has been adopted for abatement of acid mists. Pulp and paper industry pollutants are fly ash, dust and odors. Electrostatic precipitators, dust scrubbers, and spray towers are used to combat these problems. Air pollution by the petroleum refining industry is caused by sulfur

compounds and hydrocarbon loss. Sulfur compounds can be reduced by absorption and hydrocarbons by several control methods. The main pollutant from the steel industry is dust, which can be controlled by electrostatic precipitators and wet scrubbers. The main problem of the food industry is control of odor, which is combatted by activated carbon adsorbers. Dust from cement industries is best controlled by glass fabric bag filters or cyclone collectors. Costs for 1959 are given for the various control methods.

6365 APTIC NUMBER 15786

IMPROVEMENTS IN THE REMOVAL OF GASEOUS WEAK ACIDS FROM GASES CONTAINING THE SAME. (Farbenindustrie (I. G.) A. G., Frankfurt, Germany) British Pat. 467,579. 8p., June 17, 1937. (Appl. Nov. 25, 1936, 3 claims).

An improvement in the removing of weak acids from gases by washing is described. The improvement is in the composition of the diamine washing liquid. The compound consists of two nitrogen atoms with two groups on each and an aliphatic hydrocarbon radical containing at least one free or substituted hydroxyl group connecting the nitrogen atoms. The substituted hydroxyl group is preferably an etherified or esterified hydroxyl group. The two groups on the nitrogen atoms are alkyl, cycloalkyl, aryl, or aralkyl groups which do not contain hydrogen attached to the nitrogen atom. This process is of importance in the purification of coke oven gases because benzene and hydrogen sulfide may be washed out in a single operation and both can be expelled again in a single regeneration.

6366 APTIC NUMBER 16437

Ficai, Celestino
ABSORPTION, BY MEANS OF COLLOIDAL OXIDES AND ACTIVATED CARBON, OF SULFUR DIOXIDE CONTAINED AS A TRACE COMPONENT OF GAS MIXTURES. (Assorbimento a mezzo di ossidi colloidali e di carbone attivo dell'anidride solforosa contenuta nelle miscele gassose in piccole percentuali). Text in Italian. Giorn. Chim. Ind. Appl., 10(4):199-203, 1928. 10 refs.

The removal of sulfur dioxide from industrial waste gases calls for a process that can absorb the gas from a mixture with less than 5% SO2 content. The use of silica gel, alumina, and activated carbon are summarized from the literature. The methods of Grubl (silica gel) and Munro and Johnson (alumina) are described in detail. An earlier experiment was repeated on the SO2-absorbing power of alumina, using activated carbon. Carbon was far superior in absorbing power, and, because it does not lose this power as readily in the presence of moisture, gases to be treated need not be previously dehydrated. Silica gel is the most readily activated of the three substances and is less costly, but all three substances have a common disadvantage: an SO2 content below 3-4% by volume is not easily recoverable without the use of elaborate, costly procedures.

6367 APTIC NUMBER 15857

Fleming, Edward P. and T. Cleon Fitt
PROCESS FOR THE RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES. (American Smelting and Refining Co., New York) U. S. Pat. 2,399,013. 4p., April 23, 1946. (Appl. Sept. 12, 1944, 6 claims).

Most sulfur dioxide recovery processes using organic base absorbents require that the base be heated to expel the sulfur dioxide. During heating some of the base is oxidized to sulfate, necessitating expensive stripping and regeneration operations to return the absorbent in nonsulfate form. These disadvantages are overcome by using anhydrous dimethyl aniline as the absorbent medium in a process reducing the amount of heat necessary to recover the absorbent. Sulfur dioxide-containing gases are passed through bubble cap towers in countercurrent flow the dimethyl aniline and the sulfur dioxide transferred to the absorbent in an exothermic reaction at low temperatures. Cooling means are provided to remove the heat of reaction and enhance the transfer capacity of the absorbent. The gas mixture is then passed through soda and acid scrubbers where it is irrigated with soda and dilute sulfuric acid solutions. These solutions are combined to effect a preliminary separation of the dimethyl aniline from the composite solution without heating. The bulk of the absorbent is readily recovered for use in the absorbing step by heating the remainder of the solution to strip it of sulfur dioxide. A substantial portion of the heat comes from the water phase of the stripped absorbent which drives off the absorbent with water vapor.

6368 APTIC NUMBER 15991

Fleming, Edward P. and T. Cleon Fitt
RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES. (American Smelting and Refining Co., New York) U. S. Pat. 2,295,587. 3p., Sept. 15, 1942. (Appl. Nov. 25, 1939, 7 claims).

A cyclic process for recovering sulfur dioxide from smelter smoke, flue gases, and the like uses an aromatic amine as the reagent absorbant. Compared to other methods, the process, which preferably takes place in a bubble tower, greatly reduces reagent losses and regenerative costs. Sulfur dioxide-bearing gases, after cleaning to remove nongaseous contaminants, are passed to the bottom of an absorber where they flow upward in countercurrent to the absorbent, preferably dimethylaniline. Within the absorber, the sulfur dioxide is transferred from the gas mixture to the dimethylaniline, with the efficiency of the transfer enhanced by controlled cooling of the absorber. The sulfur dioxide-depleted gases are passed through sodium carbonate and sulfuric acid solutions and steam is added to free the gases from the reagent. The aromatic amine and sulfur dioxide mixture is passed through a heat exchanger on its way to the stripping tower. The excess steam and reagent vapors are brought into contact with the aromatic amine and sulfur dioxide mixture to expel the latter and yield a warm stripped reagent. The stripped reagent is further cooled and separated into two components, mainly water and reagent. The anhydrous reagent is returned for treating additional volumes of sulfur dioxide-bearing gases.

6369 APTIC NUMBER 15825

Forwergk, Karl Heinz
FULLY AUTOMATED WET DUST COLLECTION WITH RECOVERY OF THE CIRCULATING WASH WATER AND AUTOMATIC DUST CAKE REMOVAL. (Vollautomatische Nassentstaubung mit Kreislaufwasseraufbereitung und selbsttaetiger Staubkuchenaustragung). Text in German. Chem. Z./Chem. App., 92(10):359-362, May 20, 1968.

A wet dust collection system is described which has been successfully operating in a foundry for three years. The exhaust fan draws off the dust-laden gas which has temperatures of up to 600 C. In a venturi scrubber, the dust particles are washed out by centrifugal force. The cleaned gas goes to a water droplet separator and leaves through the stack. The mixture of water and sludge is dehydrated in a fully automated filter press. The separated water is returned to the scrubber where it is atomized again. Evaporation losses in the scrubber are supplied by cooling water. The filter press is automatically emptied. The filter cake with a water content of 33% falls through a shaft onto a wagon which brings it to the dump site. Measurements yielded a dust content in the cleaned gas of 156 mg/standard cu m, which amounted to a collection efficiency of 96.1% as compared with the dust content of 4 g/standard cu m in the uncleaned gas. During the four-week measuring period, 453 tons of iron were melted and 3833 kg dust separated. At operating temperatures of 400 to 600 C, the evaporation losses in the scrubber were about 1.5 to 2.0 cu m/hr. Since the water which is atomized in the scrubber is neutralized with calcium, a high amount of SO2 is washed out. In the dirty gas, 180 mgSO2/standard cu m were measured; in the cleaned gas, the SO2 content was just 10 mg/standard cu m.

6370 APTIC NUMBER 16113

Franzky, Ulrich
ACTIVATED CHARCOAL FILTER FOR RECLAMATION OF SOLVENT FROM THE EXHAUST AIR OF CHEMICAL (DRY) CLEANING MACHINES. (Kleinaktivkohlefilter zur Loesungsmittelrueckgewinnung aus der Abluft chemischer Reinigungsmaschinen). Text in German. Wasser Luft Betrieb, 12(3):157-161, March 1968.

Beginning January 1, 1968 all dry cleaning machines in the state of North Rhine-Westphalia must be equipped with activated charcoal filters if trichlorethylene or perchloroethylene are used as solvents. Not more than 200 mg of solvent/cu m of waste gas may be emitted. This will eliminate disagreeable odors and halve solvent consumption. The activated coal filters come in various sizes. The simplest version adsorbs 10 to 100 kg perchlorethylene. The twin version is fully automatic and has an electric steam generator. Waste air entering from the top of the unit is pressed through the activated coal. The steam passes the coal in the reverse direction, from bottom to top. The mixture of solvent and steam is condensed in the cooler. If in sufficient steam for the regeneration of the coal is available, because a dry cleaning machine is electrically heated, an electric steam generator must be installed or the entire dry cleaning machinery is switched to steam heating. The question of the most economical bag to use must be decided on an individual basis. The regeneration time is generally 20 to 40 min.

6371 APTIC NUMBER 16555

Fukui, Syuzo
EXAMPLES OF GAS INJURY BY HYDROFLUROIC ACID AND NITROGEN DIOXIDE, AND REMOVAL OF THE GASES FROM WASTE GAS. (Fukka suiso oyobi nisanka chisso ni yoru kogai to sono jogai jisshirei). Text in Japanese. Kogai to Taisaku, (J. Pollution Control), 2(7):481-486, Aug. 15, 1966. 3 refs.

Among the methods of nitrogen-dioxide removal, washing by water or alkaline solutions are only 50% effective. The author investigated a method based on ammonia gas. For the sake of comparison, an experiment using water alone was conducted. Nitrogen dioxide concentration was about 200 to 300 ppm; gas velocity, 0.6 l/min; and water volume, 20 ml. Removal efficiency was only 30 to 40%. Next, washing by a caustic soda solution was examined. The caustic soda concentration was 10% under identical experimental conditions. The rate of removal was 40 to 50%. The rate of nitrogen dioxide removal by ammonia was 85 to 95%. The drawback of this method, however, is that it generates white smoke of ammonium nitrite or nitrate. In the experiments conducted at a plant site, washing by water removed only 12 to 55% nitrogen dioxide while ammonia removed 70 to 93%. Hydrofluoric acid is harmful to silkworms. Mulberry leaves containing 1 mg of fluorine per 100 g of leaves completely killed silkworms. Elimination of hydrofluoric acid was comparatively easy. Satisfactory results were achieved by alkaline washing. The removal rate of this method was higher than 99% and the acid concentration of tail gas was lower than 1 ppm. The mortality rate of silkworms fed untreated mulberry leaves was 3.0 percent; that of controls was 2.0.

6372 APTIC NUMBER 16473

Gallagher, James C.
CONTROLLING AIR POLLUTION IN GRAPHIC ARTS PLANTS. Photoplatemakers Bull., 58(7):24, 53, Dec. 1968.

The control of dusts in graphic arts plants is discussed. Less dust means less time spent for opaquing and higher quality negatives and positives. The dust rising from the floor is the worst type of dust. After being on the floor, it is full of metal filings, oil, and other contaminants. It is very abrasive on the moving parts of presses and other machinery. Dusts remain in the air because of static electricity or the absence of electrons. The easiest control is the polarity neutralization method. When this device is used in a press room, stripping room, etc., it gives a negative charge to ceilings and walls. The dust particles that are attracted to the floor will not return to suspension in the air.

6373 APTIC NUMBER 16623

Ganz, S. N., I. Ye. Kuznetsov and M. A. Lokshin
DETERMINATION OF DIMENSIONS OF HOLLOW TOWERS FOR CLEANING COKE GAS OF HYDROGEN SULFIDE. (K opredeleniyu razmerov polykh bashen dlya ochistki koksovogo gaza ot serovodoroda). Text in Russian. Koks i Khim., no. 9:48-50, 1964. 1 ref.

Data on H2S elimination from coke gas in hollow atomizing scrubbers as previously reported demonstrated the high effectiveness of these devices. It was previously shown that the rate of absorption of H2S by a Na2CO3 solution depends on a set of physico-chemical, hydrodynamical and geometrical parameters. New investigations using a semi-industrial test set up enabled the determination of the effect of each of these parameters on the rate of the absorption process and to representation of the quantitative interrelations among these parameters in terms of dimensionless ratios. An empirical expression was derived using the adsorption-rate coefficient; the diameter of the atomizer; the coefficient of molecular diffusion of a gas in another gas; the rate of rotation of the atomizer; the kinematic viscosity coefficient of the liquid; the velocity of the gas; the kinematic viscosity coefficient of the gas; the coefficient of molecular diffusion of the gas in a liquid; the wetting rate; the concentration of the absorbed component in the gas; and the concentration of the absorbent in the solution. The dimensionless coefficient is a function of temperature and is found from the expression. A sub t equals 10 times 10 to the minus 6th power. (Pr sub l(C sub l times t)) to the 2.7th power, where C sub l equals 50 kg/cu m Na2CO3 and t is the operating temperature of the scrubber. The dimensionless expression fits well the experimental data and can be used to calculate the principal dimensions and values of operating parameters of hollow scrubbers for absorption of H2S from coke gas. This is illustrated by a detailed calculation of a hollow scrubber for cleansing of 60,000 cu m/hr of coke gas containing 15 grams/cu m of H2S at a temperature of 30 C and a Na2CO3 concentration in the solution of 50 kg/cu m to a required degree of purification of 90%.

6374 APTIC NUMBER 15850

PROGRESS IN THE DEVELOPMENT OF PROCESSES FOR THE LIQUID REMOVAL OF HYDROGEN SULPHIDE. Gas World Gas Coke, 158(4140-4141): 822, 826-827, 829-831, Dec. 21 and 28, 1963. 13 refs.

Liquid purification processes in preparation of town gas depend on one or both of the methods of hydrogen sulfide (H2S) removal: combination with an alkali, usually soda or ammonia, to form a hydrosulfide and oxidation by a suitable reagent, resulting in the formation of free sulfur. The absorption/desorption methods (Seaboard process, Koppers Vacuum Carbonate process) use sodium carbonate in dilute solution as the washing medium for absorption. Since the reaction is reversible, it is impossible to remove all the H2S; equilibrium is reached when the partial pressure in the gas leaving the absorber is equal to the equilibrium H2S vapor pressure of the incoming solution. Absorption/oxidation processes are utilized where absorption is carried out by a reagent capable of completely 'fixing' the hydrogen sulfide, so that regeneration of the absorbent can be effected by oxidation with recovery of elemental sulfur. The Manchester process utilizes multiple washing towers instead of a single tower; the reacting medium is in a suspension of active ferric hydroxide in alkaline solution. The spent solution from the H2S washers is regenerated in separate vessels by oxidation; free sulfur thus produced is recovered by a 'frothing-off' technique. However, the sodium carbonate/ferric oxide system suffered from defects which could not be overcome; thus, the Stretford A.D.A. process was developed which used an alkaline solution of the isomers sodium anthraquinone 2,6-disulfonate and sodium anthraquinone 2,7-disulfonate, which are water soluble. The Stretford A.D.A./Vanadate process adds a vanadium salt to the washing liquor, increasing the reaction rates for the oxidation of hydrosulfide to sulfur. Research has also been conducted on the removal of H2S in high-pressure gasification processes.

6375 APTIC NUMBER 16160

George, D. B., L. Crocker, and J. B. Rosenbaum
THE RECOVERY OF ELEMENTAL SULFUR FROM BASE METAL SMELTERS. Mining Engineering, 22(1):75-77, Jan. 1970.

Several sulfur removal systems are available, but the scrubbing solutions can not be regenerated easily to recover sulfur or sulfuric acid. The proposed process for removing SO2 and producing sulfur from the smelter gases is based upon the phenomena that when SO2 and H2S are absorbed in a suitable aqueous or organic liquid, they react rapidly to form elemental sulfur and water. The gas is cleaned of particulate matter and SO3 and cooled in a water spray tower complemented by an electrostatic precipitator, if necessary. The SO2 is absorbed in a packed tower by a suitable liquid. The SO2 loaded liquid is reacted with H2S, the sulfur formed is recovered, and the absorbent liquid is recycled. Two-thirds of the sulfur is recycled and reacted with methane and steam to produce the H2S needed for the reaction. Chemical analysis of the recycled solutions showed that they contain polythionic acids and polythionates ranging from 2-6 atoms per molecule, in addition to thiosulfate, sulfite, and sulfate. The reactions can be controlled to give adequate absorption of SO2 and at the same time produce sulfur, by the use of a solution that will buffer at a pH of 3.0-3.7. Aqueous solutions that worked well were sodium acetate and sodium citrate. The preferred organics were tributyl phosphate and tributoxy ethyl phosphate. Other classes of organics for possible use include the glycols and modified silicones. Two small-scale SO2 absorption units were operated to obtain data under continuous operating conditions with sodium citrate as the absorbent. The sulfur produced was a pale yellow, high-purity, crystalline, and easily filtered product. Further work is need to solve the problem of wash solutions being too dilute for direct re-use. The production of H2S was also briefly discussed.

6376 APTIC NUMBER 15778

PROCESS OF PURIFYING GASES, ESPECIALLY SYNTHESIS - AND FUEL-GASES. (Gesellschaft fuer Lind's Eismaschinen A. G., Hoellriegelskreuth, Germany and Lurgi Gesellschaft fuer Waermetechnik m. b. H.)

British Pat. 692,804. 13p., June 17, 1953. (Appl. Sept. 13, 1950, 16 claims).

A process for purifying gases derived from synthesis, cracking, hydrogenation, and other chemical processes was invented. Undesirable components of the gases, particularly hydrogen sulfide, organic sulfur compounds, carbon dioxide, resin-forming compounds, and low boiling hydrocarbons, are removed simultaneously in a washing and cooling process. The washing operation is done at 0 C or lower and 2 atm pressure with a polar washing agent. The washing operation can be carried out in a series of stages with the same or different washing agent. The freezing point of the washing liquid must by lower than the washing temperature. The liquid is usually composed of oxygen-containing compounds such as low molecular weight alcohols, ethers, esters, ketones, and organic acids or nitrogen-containing compounds such as ammonia, amines, and pyridine bases. Complex-forming metal salts may be added to the washing agent to increase the solubility of all the components to be washed out. The regeneration of the washing agent is done in stages to remove the substances separately in a concentrated form.

6377 APTIC NUMBER 15965

Girsewald, Conway Baron von, Gerhard Roesner, and Max Wohlwill
PRODUCTION OF CONCENTRATED SULPHUR DIOXIDE. (American Lurgi Corp., New York, N. Y.) U.S. Pat. 2,192,461. 3p., March 5, 1940. (Appl. March 11, 1938, 1 claim).

A method of recovering sulfur dioxide by washing sulfur dioxide gases with organic bases and expelling the sulfur dioxide by heating is described. A washing liquid (of low vapor pressure) absorbs the bulk of the SO2 content of the gases. The scrubbed gases, partially freed of SO2 and containing some of the washing liquid, are treated with SO2 gas in the presence of water. This forms a separable mixture of an organic liquid and an aqueous sulfite of the organic base. This is separated by using the aqueous liquid in the treatment of a fresh supply of SO2-containing gases. The recovered organic liquid is returned to the scrubbing operation. Suitable treating liquids comprise high-boiling (preferably refined) mineral oils, e.g., those boiling above 200 C.

6378 APTIC NUMBER 15858

Gleason, George Homer and Alfred Cutler Loonan
METHOD OF RECOVERING SULPHUR DIOXIDE. (Guggenheim Brothers, New York). British Pat. 523,845. 7p., July 24, 1940. (Appl. Jan. 16, 1939, 8 claims).

The invention relates to the advantages of dimethyl aniline for regenerative absorption processes in which sulfur dioxide is expelled from gas mixtures by heating and/or reduction in pressure. Dimethyl aniline provides an economical method of recovering sulfur dioxide or sulfur dioxide products, in gaseous or liquid form, from gases produced by the roasting of pyrites, sulfide ores, or other metallurgical raw materials containing metal sulfides. The absorbent can be used over a wide temperature range without producing solid reaction products or undesirable viscosity increases. Preferred temperatures are from 10 to 40 C; the preferred absorption equipment is a bubble tower containing pools of dimethyl aniline through which the sulfur dioxide-containing gases are bubbled at atmospheric pressures. One or more of the pools is maintained below 15 deg to dissipate the heat developing during absorption and to facilitate absorption. Waste gases that are discharged from the upper portion of the tower contain less than 0.5% sulfur dioxide. The solution of sulfur dioxide and dimethyl that is discharged from the bottom of the tower contains from 50 to 400 grams per liter of sulfur dioxide. The waste gases are passed to a scrubber where entrained dimethyl is removed by a suitable reagent such as sulfuric acid. The absorbent is regenerated and stripped of sulfur dioxide by water or sodium sulfate in a stripping tower. Sulfur dioxide is passed through a cooler, drying tower, and condenser to storage tanks.

6379 APTIC NUMBER 15993

Gleason, George H. and Alfred C. Loonam
RECOVERY OF SULPHUR DIOXIDE. (Guggenheim Bros., New York, N. Y.) U. S. Pat. 2,186,453. 6p., Jan. 9, 1940. (Appl. Jan. 17, 1938, 4 claims).

A process for the recovery of sulfur dioxide from gases is reported. A series of pools of absorption liquid are formed by flowing dimethylaniline downward through a bubble plate tower. The gases containing 3-6% SO2 by volume are directed upward through the pools of absorption liquid in the tower at atmospheric pressure. Sulfur dioxide is absorbed by the dimethylaniline, which is cooled to 10-20 C to facilitate absorption. Tail gas is discharged from the last pool at the top of the tower. This contains less than 0.5% SO2 by volume. A solution consisting of sulfur dioxide and dimethylaniline is withdrawn from the bottom of the tower. Sulfur dioxide is expelled from the solution by heating and collected.

6380 APTIC NUMBER 16325

Gottwald, Miroslav and Karel Obroucka
MODEL RESEARCH OF FLAME AND WASTE GAS AERODYNAMICS IN OPEN-HEARTH FURNACES. (Modelovy vyzkum aerodynamiky plamene a spalin martinske pece). Text in Czech. Hutnicke Listy (Prague), 24(12):843-849, Dec. 1969. 8 refs.

An isothermal model was applied to the study of the flame and waste gas aerodynamics in the open-hearth furnace. The flow was studied by measuring the selected sections with the help of a pneumatic probe provided with three holes. The tests revealed that the furnace was operated with the atomizing air volume adjusted wrongly, which resulted in the insufficient momentum of the oil burner. Corrections were suggested and were checked in the model tests. Theywere then put into operation. As a result, the heat time was cut and the furnace output was increased. (Author abstract modified)

6381

APTIC NUMBER 16435

EXHAUST AIR PURIFICATION AND SOLVENT RECOVERY IN GRAVURE PRINTING. Gravure, 1969:10-12, 64, March 1969.

The operation and economic aspects of a German solvent recovery system for gravure printing shops are reviewed. Exhaust air from rotary presses is first forced through a filter to extract paper dust and small paper particles and then through one or several parallel adsorbers filled with activated carbon. Continuous operation requires at least two adsorbers which can be charged and regenerated alternately. Regeneration of the activated carbon is accomplished by steam treatment, followed by drying and cooling in gravel placed underneath the activated carbon layer. The economic operation of the recovery system depends on a high solvent concentration in the exhaust air and on automatic operation. To eliminate variations in solvent content of the exhaust gas, each exhaust pipe on the individual printing units can be equipped with a shutter that closes automatically as soon as the unit comes to a standstill; air free of solvent cannot be exhausted. The solvent content of air from the adsorbers is measured by continuously functioning analyzers. When small amounts of solvent are detected, the adsorber in question is automatically shut off from the exhaust air stream. Estimated operating costs for recovering 98% or more of the toluol used during printing are between $15-20 per long ton of toluol recovered.

6382

APTIC NUMBER 16234

Greco, Guiseppe
IMPROVEMENTS RELATING TO THE CATALYTIC OXIDATION OF SULPHUR DIOXIDE TO SULPHUR TRIOXIDE. (Industrie Chimiche Dr. Paslini SpA, Milan, Italy) Brit. Pat. 749,645, 8p., May 30, 1956. (Appl. Aug. 14, 1953, 5 claims).

A method for the catalytic oxidation of sulfur dioxide to sulfur trioxide is described that overcomes the disadvantages associated with oxidizing sulfur dioxide to sulfurous anhydride over a vanadium catalyst at 410-420 C. At these temperatures, the catalyst inside the reaction chamber slowly foliates into blackish laminae and is subject to nonuniform distribution. These shortcomings are avoided by passing a mixture of sulfur dioxide and oxygen over a catalyst containing 4-8% vanadium pentoxide and 2-5% of an oxide of bismuth at 380 C or below to effect conversion of the sulfur dioxide to sulfur trioxide. Complete conversion is achieved, without preliminary cooling in a heat exchanger, by passing the gaseous product directly to the remaining body of the catalyst.

6383

APTIC NUMBER 16124

Gross, Edward
DRIVING WITH METHANE. Sci. News, 97(3):73-74, Jan. 17, 1970.

A dual-fuel system was developed which gives cars, trucks, and buses the option of operating on gasoline or on the compressed natural gas, methane. Converting the system is a simple matter and the cost of an entire system is $350 (1970). The few moving parts in the system and its adaptibility permits its continual use. There are only three main functional parts to the system: the cylinders of compressed methane, the regulator, and the gas-air mixer. The pressure cylinders, which range from 30-lb units containing 100 cu ft of gas to 100-lb cylinders containing 300 cu ft, can be put in or under the [illegible]stbed of a pickup truck; in the trunk of a car; or under, in, o[illegible] on a bus of truck. The function of the regulator is to reduce the pressure of the gas coming from the highly pressurized cylinder so that it can feed into the gas-air mixer mounted on top of the carburetor. The mixer, the heart of the system, is the equivalent of a carburetor and air filter and replaces the ordinary air filter that sits on top of the engine. Because of the limited mileage (two 300 cu ft cylinders constitute 120 miles), the system is not meant to be operated on natural gas on the open road where auto emissions are not a problem. It is mainly designed for stop-and-go city traffic. Advantages include quick starting in cold weather, no vapor lock in hot weather, and low maintenance costs because of cleaner fuel. In addition, there is no venting of pollutants from the fuel and no safety problem because the natural gas is lighter than air and rises. Disadvantages include the amount of space taken up by the cylinders because the engine is not modified in any way, and also some power loss at high speeds. The system also accomplishes a 90% reduction in emission of gaseous contaminants.

6384

APTIC NUMBER 16241

Harlow, Earl V.
PURIFICATION OF GASES. (Koppers Co., Inc., Monroeville, Pa.) U. S. Pat. 2,746,563. 3p., May 22, 1956. 4 refs. (Appl. June 9, 1953, 6 claims).

The efficiency of electrostatic precipitators in removing fly ash from stack gases is impaired when the resistance of the dust layer accumulating on the collecting electrode of the precipitator is high. Under these conditions the 'black discharge' phenomenon occurs that prevents the charge from escaping as fast as new ions arrive from the discharge electrode. The result is excessive sparking between the discharge and grounded electrodes, and inability to operate at normal voltage. The discharge can be largely eliminated by passing sulfur dioxide-containing waste gas over catalytic rods and converting the SO2 and SO3 before the gas stream enters the precipitator. Platinum-aluminum coated rods are satisfactory catalysts, but zinc oxide and vanadium pentoxide coatings are also effective. The preferred concentration of the SO3 in the stream entering the precipitator is 0.002% by volume. To obtain this concentration, only a minor portion of the SO2 has to be converted to SO3.

6385

APTIC NUMBER 16007

Hasenclever, D.
THE TESTING OF HIGH-EFFICIENCY FILTERS FOR THE COLLECTION OF SUSPENDED PARTICLES. Oak Ridge National Lab., Tenn. Intern. Symp. Fission Prod. Release Transport Under Accident Conditions, Oak Ridge, Tenn., April 1965, p. 805-813. (April 5-7).

Acceptance tests for low-penetration filters ('special filters S') are closely related to methods of testing particle filters for dust respirators. Testing is done with three kinds of solids and liquid particles. The entire filter element is tested with oil fog in which all drops have diameters below 1 micron and in which more than 80% of the drops have diameters between 0.3 and 0.5 micron. In a 20-min. test, collection efficiency of a filter must be greater than 99.70 plus or minus 0.02%. An 'oilthread' test must reveal no leaks in the housing and no visible pores in the filter material. Sections of the filter element are tested with radioactively tagged natural atmospheric aerosols with a mean diameter of about 0.07 micron. The lowest measured collection efficiency cannot be less than 99.90 plus or minus 0.02%. Filter element sections are also subjected to tests with ground quartz dust smaller than 10 micron. Only filters whose filtering properties might deteriorate at high dust loading are tested. In a 60-min. test, the specific dust loading and corresponding flow resistance are reported. Because the concentration of dust cannot be increased without modification of size distribution, the measured results are not as accurate as those for the other tests. Consequently, the filter should not show a collection efficiency below 99%. Results obtained with 700 filter materials and elements show that these acceptance tests provide more information about collection efficiency than a single DOP test.

6386 APTIC NUMBER 16556

Hashimoto, Masayuki
MOTOR VEHICLE EXHAUST GAS CONTROL IN VIEW OF TRAFFIC PATTERN IN OSAKA CITY. (Soko patan yori mita jidosha haiki gasu to sono taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(7):421-429, July 15, 1968.

Drive patterns of four mode cycles, namely idling, acceleration, regular speed, and deceleration, are surveyed and some countermeasures to reduce the carbon monoxide emissions are briefly discussed. The test on drive patterns involved an important aspect of air pollution control in Osaka city, where pollution due to engine exhaust obviously originates in traffic tie-ups at intersections. In 1966, the index of traffic at 39 main intersections was 1569 compared to that of 100 in 1959. The same rate of increase was recorded in 1967 and 1968. The results are an increased number of traffic delays and longer waiting times for go-ahead signals. The survey included a test drive on a typical patterned course, according to a schedule simulating the traffic circumstances with respect to social and business activities. The result showed both idling and deceleration were responsible for the increase of carbon monoxide emission. The key to reducing emissions lies in minimizing them at idling and deceleration modes. It is concluded that carbon monoxide emission at idling can be reduced by decreasing gasoline consumption and the use of a rarefied gas mixture.

6387 APTIC NUMBER 15837

Hebbard, George M.
RECOVERY OF SULPHUR DIOXIDE AND DICLEFINS FROM SULPHONES. (Dow Chemical Co., Midland, Mich.) U. S. Pat. 2,384,376. 7p., Sept. 4, 1945 (Appl. Nov. 3, 1941, 7 claims).

When liquified sulfur dioxide is used to separate diolfins such as butadiene from cracked-oil gas or mixtures of the gas and hydrocarbons, a sulfone is formed and then chemically decomposed to form a gaseous mixture of sulfur dioxide and olefin. Separation of the sulfur dioxide from the mixture by scrubbing with water is unsatisfactory because of the heat required for vaporization and the corrosive nature of the resulting sulfuric acid. An improved method for recovering sulfur dioxide from a sulfone thermally decomposes the sulfone, at pressures sufficient to liquefy the mixture, in the presence of a liquid paraffin hydrocarbon of boiling point higher than the diolefin. The solvent also effectively separates the reaction products to inhibit or prevent recombination into the sulfone. Suitable solvents are hexane, octane, or decane and liquid petroleum factions such as gasoline, naptha, or kerosene. The sulfone-solvent mixture is passed through the heating zone of a 'sulfone decomposer' and heated to 120-150 C. Here the sulfone is partially decomposed into sulfur dioxide and the diolefin. The resulting liquified mixture is then cooled below 120 C and, while maintained under pressure, passed to an extraction tower. Additional quantities of liquified sulfone are passed through the tower in countercurrent flow. The resulting solution of sulfur dioxide and sulfone is continuously withdrawn from the bottom of the tower; the solution of diolefin and liquid paraffin hydrocarbon is continuously withdrawn from the bottom of the tower. The reaction products of the solution are vaporized and collected in a form of 95% or higher purity. The solvent is cooled and returned to the tower for recyling.

6388 APTIC NUMBER 15782

Heggestad, H. E., H. A. Menser, and W. A. Bailey
A SYSTEM FOR FILTERING AIR THROUGH ACTIVATED CARBON TO BE USED WITH FAN PAD COOLING IN GREENHOUSES. Preprint, Air Pollution Control Assoc., Pittsburgh, 6p., 1967. 3 refs. (Presented at the Air Pollution Control Association Annual Meeting, 60th. Cleveland, June 13, 1967.)

An air filtration system was designed for use with fan-pad coolers in greenhouses. The design of the air filtration system was influenced by the necessity of preventing air pollution injury while maintaining optimum temperature and moisture conditions essential for good plant growth. There was also a need for a greenhouse in which the growth of plant species could be compared with and without activated carbon filters. The system involves a combination of forced and exhausted air. Each greenhouse section has a bank of twelve activated carbon filters composed of 45 pounds of coconut shell-activated charcoal. One of the four greenhouse sections has only cooled unfiltered air to enable growth comparison of plants to be made over long periods of time. Between the carbon filters, there is a row of twelve particulate prefilters which have a dust-holding capacity. A centrifugal fan is placed at ground level. A weather cover helps protect the fan and filters from moisture. To attain uniform air distribution to the carbon and particulate prefilters, twelve registers are manually adjusted at the time of installation. Also, to facilitate better air distribution, a vertical duct is attached to a horizontal duct in

a V-shaped pattern; a metal baffle, serving as an air turning vane, is located at the point of attachment to the horizontal duct. A balancing damper in the vertical duct permits reduction of the air supply to the carbon filters and greenhouse when some ventilation but very little cooling is desired. Under these conditions, the fiber pads used in cooling will be dry. Two propeller exhaust fans on the opposite side of the greenhouse are used only when maximum cooling is required. The exhaust fans may be operated at two speeds to permit greater control of the air flow. The air filtration and cooling system is controlled by thermostats. The system for filtering and cooling air is sufficientyly flexible so that modifications can be made as necessary.

6389 APTIC NUMBER 15995

Herold, Paul and Georg Markus
RECOVERING HYDROGEN CHLORIDE AND SULPHUR DIOXIDE FROM GAS MIXTURES. (Assignee not given.) U. S. Pat. 2,301,779. 2p., Nov. 10, 1942. (Appl. Nov. 19, 1940, 3 claims).

A method of recovering hydrogen chloride and sulfur dioxide separately from gas mixtures is described. A gas mixture is washed with a medium liquid which consists of aromatic compounds containing oxygen in an ethereal linkage and of aromatic compounds containing oxygen in a phenolic linkage. Suitable compounds are xylenol and diphenyl ether. The gas mixture may either be passed through the liquid while it is stationary or led in a counter-current to the liquid flowing down, preferably in trickling towers charged with filter bodies. The hydrogen chloride leaves the washing liquid in a dry state free of sulfur dioxide. The washing liquid is easily regenerated by expelling the absorbed sulfur dioxide by heating, applying reduced pressure, or by subjecting it to both measures simultaneously. The washing liquid can be reused after cooling.

6390 APTIC NUMBER 16039

Herrick, Robert A.
A BAGHOUSE TEST PROGRAM FOR OXYGEN LANCED OPEN HEARTH FUME CONTROL. J. Air Pollution Control Assoc., 13(1):28-32, Jan. 1963. 10 refs. (Presented at the 55th Annual Meeting of APCA, Chicago, May 20-24, 1962.)

Tests were undertaken to determine the collection efficiency of glass fabric filter bags for the red iron oxide fumes produced by injecting oxygen into open hearth steelmaking furnaces. The three basic fabric constructions tested were all-filament fiber, bulked or texturized fill fabric, and staple fill fabric. All tests were run at a filter velocity of approximately two ft/min and at bag gas temperatures of about 400 F. The primary variable used to analyze test data was filter drag, the ratio of the pressure drop across the bags to filter velocity. Also evaluated were four methods of removing collected dust cake from the filters: simple collapse, sonic cleaning, pressure jet cleaning, and bag shaking. Collection efficiency was very high during all tests. Although on grain loading efficiency tests were made, no dust plumes were visible and the outside of the filter bags remained clean. While the dust-fabric combination returned to an intermediate rather than low pressure drop after the bag cleaning cycle, the slow rise in pressure drop during cake buildup offset this disadvantage. The level of the pressure drop after cleaning was most affected by the physical intensity of the cleaning operation. No major difficulties were encountered that would prevent the satisfactory operation of a baghouse type dust collector on an oxygen lanced open hearth furnace. However, it is important to prevent condensation of furnace gases on the bags. A slight amount of furnace leakage is detrimental to a collapse-type cleaning method.

6391 APTIC NUMBER 16101

Himsworth, Francis Robert and John Stanley Dunn
PROCESS FOR THE PRODUCTION OF ANHYDROUS CALCIUM SULPHATE AND PLASTERS MADE THEREFORM. (Imperial Chemicals Industries Ltd., London, England) British Pat. 454,239. 2p., Sept. 25, 1936. (Appl. March 25, 1935, 4 claims).

When sulfur dioxide is removed from flue gases by scrubbing the gases with aqueous suspensions containing lime or calcium carbonate, a sludge is obtained that contains calcium sulfite and calcium sulfate. Disposal of this sludge has been a problem. By heating it in an oxidizing atmosphere to 900 - 1000 C, the sludge can be converted to an anhydrous calcium sulfate suitable for the manufacture of accelerated anhydrite-type plasters. In the process, a slurry containing calcium sulfite, calcium sulfate, and water is passed through rotary kilns in countercurrent to oxidizing combustion gases, with the flow of gases regulated to maintain the material at the required temperatures in the lower end of the kiln. The anhydrous calcium sulfate obtained is then ground and mixed with 2% potassium sulfate and 1% zinc sulfate. Hardness of the plaster after one day's setting is 3.8 mm.

6392 APTIC NUMBER 16100

Hooker, George W., Stephen C. Stowe, and Lewis H. Drake
METHOD OF RECOVERING SULPHUR DIOXIDE. (Dow Chemical Co., Midland, Mich) U. S. Pat. 2,385,704. 4p., Sept. 25, 1945. (Appl. Jan. 22, 1942, 14 claims).

An improved method for recovering sulfur dioxide from mixtures containing aliphatic hydrocarbons, in particular butadiene and butylene, involves contacting the mixtures with a liquid extractant comprising tetrahydrothiophene-1,1-dioxide and nuclear substituted alkyl and alkoxy derivatives. Like liquid diolefin sulfones, these hydrothiophene dioxides have a high absorbtive capacity for sulfur dioxide. Unlike the diolefin sulfones, they are stable against thermal decomposition or oxidation by air above 200 C and can be heated to temperatures sufficient for vaporizing the absorbed sulfur dioxide. The hydrothiophene dioxides are obtained by reacting diolefin sulfones with hydrogen or a lower aliphatic radical. Extraction of sulfur dioxide from gaseous or liquid mixtures is satisfactorily carried out at room temperature and atmospheric pressure, though higher temperatures and pressures are advantageously employed to obtain a more

selective absorption. The absorbed sulfur dioxide is vaporized from the extract by raising the temperature, lowering the pressure, or both.

6393 APTIC NUMBER 15875

Hooker, George W. and Franc A. Landee
SEPARATION OF SULPHUR DIOXIDE AND LOW-BOILING HYDROCARBONS FROM MIXTURES THEREOF. (Dow Chemical Co., Midland, Mich.) U. S. Pat. 2,384,378. 5p., Sept. 4, 1945. (Appl. Nov. 3, 1941, 4 claims).

The invention concerns the separation of mixtures of sulfur dioxide and aliphatic hydrocarbons, and particulary the separation of sulfur dioxide and conjugated diolefines to recover each in an anhydrous and purified form. Separation is acheived with two extractants: a liquified organic sulfone and a liquid paraffin hydrocarbon having a boiling point of at least 20 C. Sulfur dioxide is preferably separated from a conjugated diolefine having 5 or less carbon atoms by passing it into the mid-section of an extraction tower. At the same time, a liquid fraction of petroleum is passed into the bottom of the tower. A liquified sulfone of the conjugated diolefine is passed into the tower at the top and dispersed. The flow of liquids is from the tower is under a superatmospheric pressure so they remain in liquid form. During the separation process, the resultant extract of liquid petroleum and conjugated diolefine is withdrawn from the top of the tower. The extract of liquified sulfone and sulfur dioxide is withdrawn from the bottom of the tower, the sulfur dioxide vaporized to leave the sulfone in condition for recycling.

6394 APTIC NUMBER 15836

Hooker, George W., Lewis R. Drake, and Stephen C. Stowe
SULPHUR DIOXIDE RECOVERY METHOD. (Dow Chemical Co., Midland, Mich. U. S. Pat. 2,368,545. 4p., Jan. 30, 1945. (Appl. Aug. 18, 1939, 11 claims).

A method for recovering substantially pure sulfur dioxide from mixtures with other gases or low boiling hydrocarbons involves the absorption of sulfur dioxide in liquified diolefin sulfones, preferably butadiene sulfone and isoprene sulfone. Equimolar mixtures of these or other cyclic sulfones, obtained by melting or by addition of a solvent, have great absorptive capacities for sulfur dioxide. Gaseous mixtures can be treated in scrubbing towers or other equipment suitable for extractants. Sulfur dioxide is evaporated from mixtures by warming the sulfone solution between 70-100 C, the temperature range below that at which sulfone decomposes. The vaporized sulfur dioxide is collected in the usual manner and the extractant is recovered for further use. Other compounds in the sulfur dioxide mixture are relatively unaffected by the sulfone treatment. The ratio of the recovered sulfur dioxide is four times that of sulfur dioxide recovered by using water as an extractant. In addition, sulfone treatment, unlike water treatment, does not involve the formation of a corrosive acid solution. Suggested applications of the method include the treatment of sulfur dioxide-nitrogen-oxygen mixtures produced by sulfur oxidation processes and hydrocarbon mixtures produced by petroleum processes.

6395 APTIC NUMBER 16115

Horvath, Helmuth
A SIMPLE METHOD FOR THE MEASUREMENT OF THE COLLECTION OF DUST COLLECTORS EFFICIENCY FOR THE INDIVIDUAL PARTICLE SIZES. (Eine einfache Methode zur Messung des Stufenentstaubungsgrades von Staubabscheidern). Text in German. Staub, Reinhaltung Luft, 29(11):465-7, Nov. 1969. 4 refs.

An aerosol was produced which was similar to those developing at combustion processes. It was mixed with atmospheric air and drawn through a collector, the efficiency of which was measured for the individual particle sizes with a six stage cascade impactor by isokinetic sampling, before and after the unit. An Andersen sampler was used, wherein the aerosol was drawn through a sequence of perforated plates, the holes of which became increasingly smaller. The dust particles were collected in Petri dishes. Particles with high inertia cannot follow the air stream and are precipitated. Since the speed of the air stream increases with decreasing size of the holes, smaller particles are precipitated. The Petri dishes were weighed before and after the measurement. With the data obtained by this method, the efficiency of each stage can be determined and with it, the total collection efficiency for an aerosol with known size distribution.

6396 APTIC NUMBER 15976

Horvath, Tibor, Karoly Nagy, and Ferdinand Zoltan
PROCESS TO EXTRACT SULFUR DIOXIDE FROM FLUE GASES WITH SIMULTANEOUS PRODUCTION OF MAGNESIA REFRACTORY FROM MINERALS. (Eljaras fustgasok kendioxid tartalmanak kinyeresere, magnezit tuzallo anyagnak kozetekbol valo egyideju cloallitasa mellett). Text in Hungarian. (Assignee not given.) Hungarian Pat. 152,841. 4p., Dec. 12, 1965. (Appl. May 2, 1965, 7 claims).

The 0.2-0.5% sulfur dioxide-containing flue gases from power plants are first cooled to ambient temperatures and dust particles removed. The gases are then passed to a suitable gas absorption apparatus and washed with a watery suspension of a finely ground, preheated magnesium compound such as dolomite or serpentine. The sulfur dioxide and magnesium will combine to form mainly bisulfite; the solution will have a magnesium content of 14-19 g/l. If the suspension pH is kept above 4.75, the purity of the magnesium oxide will be 95-97%. The other condition of magnesium oxide selectivity is the inhibition of the oxidation of the sulfides of the other metals, e.g., calcium, small amounts of inhibitors, e.g., p-amino-phenol will suffice. The output of the gas absorption apparatus (or reactor column) is filtered or centrifuged, and the pure magnesium bisulfide solution heated to 80-100 C. The pH of the solution is raised to 9 or more by the addition of magnesium oxide or hydroxide, one or two hrs of stirring the hot solution will precipitate more than 80% of the magnesium salts in forms that can be easily filtered from the basic solution. The filtered salts can be roasted in conventional apparatus at 700-900 C. The gases are fed to sulfuric acid

producing towers; the magnesium oxide is burned at 1500-1800 C into sintered magnesite. The sulfur dioxide removal from the flue gases is 70-90% efficient; of this quantity, 40-90% is converted to sulfuric acid. The conversion of the magnesium containing minerals is 50-90% effective; the magnesite-water is 95-97% pure.

6397

APTIC NUMBER 16541

Hosokawa, Hisashi
REVIEW AND PROSPECT FOR AIR POLLUTION CONTROL. (Taiki osen boshi no kaiko to tenbo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(1):10-17, Jan. 15, 1966.

In view of the energy transition from coal to petroleum, it is currently recognized that success or failure of air pollution control depends largely on the reduction of sulfur dioxide. Because of the quantity of petroleum consumed, sulfur dioxide is far more significant than other pollutants. Three recognized ways of reducing sulfurous gases are to remove sulfurous compounds from crude or heavy oil, to remove the sulfurous gas contained in combustion gases, and to disperse emission gases in air. The last mentioned is the most economical. The hydro removal method, for example, costs approximately $2.77/kl and its reduction rate is no more than 45%. The method is uneconomical because the price of heavy oil is $16.66/kl. Exploitation of practical measures is urgently needed. The advantage of the present emission standard can not be overlooked, since it is concerned only with restricting emissions from individual works, while the degree of air pollution is determined by total emissions. For this reason, the present emission standard does not improve the pollution situation. Current discussion on an ambient standard is based on this circumstance.

6398

APTIC NUMBER 16002

Hrdlicka, Karel
MEANS FOR REMOVING SO2 AND SO3 FROM INDUSTRIAL EXHAUST BY THE ZINC METHOD. (Zpusob zachycovani kyslicniku siry SO2 a SO3 z prumyslovych vzhalaci zinkovym zpusobem). Text in Czech. (Assignee not given.) Czech Pat. 90701. 5p., July 16, 1959.

A method is presented wherein the waste gas containing sulfur dioxide and sulfur trioxide is passed through a scrubber containing a water suspension of Zn(OH)2. The reaction produces ZnSO4 and ZnSO3(2.5H2O) followed by Zn(HSO3)2 which reacts with Zn(OH)2, rapidly converting back to ZnSO3. When processing waste gases with 1% volume SO2 and 5 g/cu m (NTP) SO3 at a flow rate of 1.0(1.5)m/sec, the suspension is removed at a rate of 1.6 to 2.5 cu m/hr per sq m of tower cross section. This method for producing 100% SO2, ZnSO4 solution, and crystalline ZnSO4(7H2O) is distinguished by the fact that the zinc salts are removed from the absorption cycle and decompose with concentrated acid.

6399

APTIC NUMBER 16337

Muenigen, E.
AUTOMOBILE EXHAUSTS AND CLEAN AIR MAINTENANCE IN THE DDR. (Motorenabgase und die Luftreinhaltung in der DDR). Text in German. Z. Ges. Hyg. (Berlin), 15(11):824-827, Nov. 1969. 10 refs.

The state of the art of measures to combat air pollution by engine exhausts is given. The first step in reducing emissions by motor vehicles was to eliminate Diesel smoke. A smoke density measuring unit was developed and distributed for extensive measurements. The results of tests with 24 different engine designs were used to work out limits. No engine with more than 0.35 g soot/cu m in the exhaust is to be manufactured; no vehicle may exceed 0.9 g soot/cu m. Car manufacturers in the DDR have already accepted these limits. Exhaust gas analyses (CO, CO2, and CH) by infrared absorption were performed with Otto engines and the hydrocarbon concentrations were measured with flame ionization detectors. Typical driving cycles were worked out and used for the tests on dynamometers. In an attempt to reduce the CO emissions, a carburetor adjustment unit was developed to adjust the idle according to the CO content. The recommendation by the United Nations' study group to limit the CO concentration in the idle to 4.5% by volume has been accepted for issuance of a guideline for the DDR. The automobile manufacturers agreed also to improve the fuel to air ratio. Catalytic afterburners have been rejected by the DDR as uneconomical. An extensive study program is under way in the DDR which is directed toward finding the type of toxicants which ought to be limited and by how much.

6400

APTIC NUMBER 15859

IMPROVEMENTS IN THE REMOVAL OF WEAK GASEOUS ACIDS FROM GASES. (I. G. Farbenindustrie AG, (Frankfurt, Germany) British Pat. 470,440. 4p., Aug. 16, 1937. (Appl. Sept. 14, 1936, 3 claims).

Gaseous weak acids are effectively removed from gases by washing the gases with liquids whose bases are polymerization products of alkyleneimines, preferably ethyleneimine. The washing liquids are then regenerated to expel the acids. The special advantage of the bases is that they reduce the tendency of the washing liquid to foam. Consequently, only simply regeneration equipment is required: there is no need to pass the washing liquid over active carbon to combat foam formation. Although the bases contain at least two nitrogen atoms, their absorptive capacity is further increased by the addition of other nitrogen-containing compounds such as monoethanol amine or amino acids. By modifying the nitrogen character of the bases, acids of different strengths can be separately washed out of the gas mixture. The addition of hydroxyl groups and/or hydrocarbon radicals is suggested to lower the volatility of the bases. The hydroxyl groups increase the solubility of the bases in water, alcohol, and other polar solvents, while the hydrocarbon radicals increase solubility in paraffin hydrocarbons and other organic solvents. Gas washing can be carried out in packed towers or movable disintegrators. The amount of solution and temperatures used depend on the nature of the gas to be washed. Other advantages of the bases are that no separation of solid substances occurs during washing or regeneration and that the solutions, because of their low viscosity, can be used in high concentrations.

6401 APTIC NUMBER 15871

IMPROVEMENTS IN THE REMOVAL OF GASEOUS WEAK ACIDS FROM GASES CONTAINING THE SAME. (I. G. Farbenindustrie A G, Frankfurt, Germany) British Pat. 450,519. 5p., July 20, 1936. (Appl. Jan. 24, 1935, 3 claims).

A process for removing gaseous weak acids from gases consists of washing the weak acid-containing gases with a liquid that is regenerated by heating. The absorbed gases are expelled by heating the liquid. The washing liquid contains at least two nitrogen atoms with 2 side groups on each atom. The nitrogen atoms are connected with an aliphatic hydrocarbon radical containing a simple or substituted amino group. The side groups consist of an alkyl or aryl group containing a hydroxyl group or a simple or substituted amino group or it is also possible for each nitrogen atom to form an alkylene group, with the remaining groups consisting of hydrogen, alkyl, or aryl group. The method is exemplified by the removal of hydrogen sulfide from side-oven gases.

6402 APTIC NUMBER 16535

Ikehata, Akira and Yasuo Kusagai
REMOVAL OF ODOR ON WASTE WATER FROM POTATO STARCH PLANT. (Bareisho denpun kojo haisui no dasshu ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(9):575-579, Sept. 15, 1968. 10 refs.

The pollution of rivers by waste water discharged from potato starch plants is discussed. The harmful effect of the waste water is caused mainly by the so-called 'water cotton' which kills microorganisms and plankton, the staple food of fish. The waste water also creates an odor problem. The present authors studied the elimination of the odor by ozone, chlorine, and open air. Aggregation and filtration alone did not remove the odor of the waste gas, but reduced biochemical oxygen demand (BOD) by 65%, chemical oxygen demand (COD) by 68%, and chromaticity by 60%. Treatment with ozone reduced COD by 55%, chromaticity by 69%, and odor by almost 100%. Chlorine also reduced odor, though its excessive use produced chlorine odor. Treatment with open air removed most of the odor, and reduced BOD by 19%, COD by 16%, and chromaticity by 32%. Joint treatment with chlorine for 20 min and ozone for one min completely removed odor, and reduced BOD by 66%, COD by 94%, and chromaticity by 97%. Joint treatment with air for one half hr and chlorine for twenty min removed most of the odor. Joint treatment with air for one half-hr and ozone for 3 min completely removed odor, and reduced BOD by 70%, COD by 67%, and chromaticity by 76%.

6403 APTIC NUMBER 15963

IMPROVEMENTS IN PROCESSES OF RECOVERING SULPHUR DIOXIDE FROM WASTE GASES. (Illinois University, Urbana) British Pat. 484,714. 6p., May 10, 1938. (Appl. Nov. 11, 1936, 6 claims).

A method of recovering sulfur dioxide from waste gases is described. The gases are cyclicly contacted with a cold, aqueous sulfite and bisulfite solution which contains ammonium salts. The solution is heated in the presence of an organic acid which is only slightly soluble in the cold solution but whose solubility increases with a rise in temperature. The acid is not present as a second liquid phase with the cold, aqueous solution when it contacts the gases. The acid is regenerated by using the hot solution from which the sulfur dioxide is removed and cooling it to remove the organic acid. The organic acid is n-butyric, isobutyric, n-valeric, isovaleric, n-caproic, or isocaproic.

6404 APTIC NUMBER 15142

Inamura, Shichiro
A SMOKE AND DUST COLLECTOR. (Baienshujin sochi). Text in Japanese. (Assignee not given.) Japanese Pat. Sho44-16311. 2p., July 18, 1969. (Appl. Jan. 20, 1966).

The present device, when attached to the top of a chimney, separates dust from smoke, both of which are led to an appropriate ground-level processing apparatus. The main components of the device are guide vanes arranged equidistantly in a circle, so that wind is directed to form a whirlwind. An obstacle plant is provided to collect dusts from the whirlwind. The collected dust is led downward through a duct. When no wind is blowing, air is forced into the device. After dust is collected, the remaining smoke is drawn out through the top of the device and led to a rinsing chamber. The suction fan on the ground is regulated according to the amount of flue gas and wind velocity. The collector can also be applied to harmful exhaust gases from chemical plants.

6405 APTIC NUMBER 16015

LIQUID SULPHUR FROM COLESHILL ALKAZID PLANT. Ind. Chemist, vol. 40:9-12, Jan. 1964.

A new high-pressure coal gasification plant is based on the Lurgi process and is expected to yield 6000 tons of sulfur a year. At the plant, the process is carried out using oxygen and steam at high pressure in five Lurgi gasifiers. The raw gas produced is treated and purified in a series of ancillary plants where carbon monoxide is converted to hydrogen, benzole is recovered, and hydrogen sulfide is removed in an Alkazid plant from which pure sulfur is recovered in the molten state. In the Alkazid plant, the hydrogen sulfide is removed from the debenzolized gas by extraction with a solution of potassium N-dimethylglycine from which it is regenerated and converted to sulfur in Claus kilns. The sulfur condensed in the kilns flows to two catalytic converters where additional sulfur is produced and then condensed. Sulfur pumps deliver the sulfur to a loading station or a sulfur storage area. The efficiency of the sulfur recovery is 95%, and the stack gases contain only 0.8% sulfur dioxide. Waste heat system is produced at the rate of 4500 lb/hr at the recovery plant.

6406 APTIC NUMBER 16197

Ioffe, L. O.
CALCULATION OF THE FINAL GAS BLOW-OFF IN THE SULFITE COOKING OF CELLULOSE. (Raschet konechnoy gazovy dluvki pri sul'fitnoy varke tsellyulozy). Text in Russian. Bumazhn. Prom. (Moscow), no. 6: 1 -20, 1966. 6 refs.

A procedure was determined for calculating the final gas blow-off in sulfite cooking of cellulose. It was shown that on decreasing the temperature of the boiler contents by 20 deg, the concentration of free sulfur dioxide in the liquor is decreased to hundredths of a percent (independent of the initial temperature and initial concentration of sulfur dioxide before the blow-off). Thus, at a 2% content of sulfur dioxide and an initial temperature of 140 deg, when the temperature is lowered to 130 deg and then to 120 deg, the sulfur dioxide content decreases to 0.181 and then to 0.009%; at an initial temperature of 130 deg decreased to 120 deg and then to 110 deg, the amount of sulfur dioxide decreases to 0.115 and 0.003% respectively.

6407 APTIC NUMBER 16562

Ionescu, T. D., G. Tudorache, and I. Radulet
THE RECOVERY OF SULPHUR DIOXIDE FROM RESIDUAL GASES BY IONIC EXCHANGE. (Recuperarea bioxidului de sulf din gazele reziduale prin schimb ionic). Text in Romanian. Rev. Chim. (Bucharest), 20(9):567-569, 1969. 3 refs.

Experiments were conducted to determine the sulfur dioxide retaining properties of various anionic substances. Of those tested, several were strong bases with a polystyrene substrate (Relite 2 A, Relite 2 AS, Kestal A300P, Kastel A500, Vionit AT1); one was a medium base in epoxy-polyamine, with amine and quaternary ammonium as active radicals (Kastel A100); and one was a weak base (Vionit AS1). Resulting data indicated that the strongly basic anionic substances, in the wet state, were good absorbers of SO2 from residual gases. Absorbing capacity depended on the type of ion supplied by the exchanger, which considerably influenced the amount of swelling that took place. The best results were obtained with anionic substances of the form R--OH. The sulfur dioxide retained by the anionic substance can be completely eluted with an ammonia solution, yielding a solution of ammonium salts.

6408 APTIC NUMBER 16188

Ishii, Sada and Satoro Sado
RECOMBUSTION BURNER OF THE EXHAUST GAS. (Haikigasu no bahnah tsuki saineanshoki). Text in Japanese. (Assignee not given.) Japanese Pat. Sho44-22567. 4p., Sept. 26, 1969. 2 refs. (Appl. May 26, 1966).

A cyclone-type recombustion chamber is installed between an internal combustion engine and silencer. A venturi tube at the entrance of the chamber draws in an amount of air proportional to the amount of exhaust gas. Inside the chamber another tube heats and burns the unburnt component of the exhaust gas. When engine speed is low, the tube is heated up by a burner to raise the temperature of carbon monoxide and other gases to a point high enough for combustion. The burner is mechanically connected with the throttle lever of the carburetor, so that the harmful components of the exhaust gas are cleaned irrespective of engine speed. The recombustion chamber of the present invention gives little loss in gas pressure head, and partially functions as a silencer. No replacement of parts is required, which makes the present invention superior to ones using catalysts.

6409 APTIC NUMBER 16227

VDI (Verein Deutscher Ingenieure) Fachgruppe Staubtechnik Duesseldorf, Germany
DUST CONTROL AT THE WORKING PLACE. (Staubbekaempfung an Arbeitsplatz). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2262, 32p., May 1966. 124 refs. Translated from German by H. Schneider, Israel Program for Scientific Translations, Jerusalem.
CFSTI: TT68-50469/4

Measures are proposed to help the industrial engineer reduce the occupational hazards caused by the presence of dust-like pollutants in working places. They are preceeded by an analysis of dust formation in various industrial processes and of the effects and forces contributing to dust spreading. General measures to reduce spreading are outlined. In the main section of the report, special attention is paid to enclosure of the dust source, dust removal by directed ventilation, aspiration and collection of dust generated, and room ventilation by natural, artificial or circulated-air ventilation. Also discussed are the factors on which air consumption depends. In considering the removal of deposited dust from floors, walls, supports, and machines, it is suggested that dust is best removed by suction devices such as vacuum cleaners and vacuum sweeping machines. For dangerous dusts, wet removal is recommended by either keeping the floor continuously moist or by flushing and spraying walls and floors. Suitable collectors for cleaning air prior to its release to the outside are schematically represented. Release of dust to the outside should take place at sufficient height above the roof or above the roof edge of the highest neighboring building. Chimney pipes without rainguards are permissiable only with wet scrubbers or if the chimney is provided with a drain. In other cases, a rainhood should be provided; to attain a plume rise, the exit velocity should be at least 10 m/sec. Model laws governing the flow of air and the movement of dust in a room are compiled in a table for use in model tests.

6410 APTIC NUMBER 16228

VDI (Verein Deutscher Ingenieure) Kommission Reinhaltung der Luft, Duesseldorf, Germany
EMISSION CONTROL BLAST FURNACE OPERATION: ORE SINTERING PLANTS (INDUCED-DRAFT PAN AND MOVING-GRATE INSTALLATIONS. (Auswurfbegrenzung Hochofenbetrieb Erzsinteranlagen (Saugzugpfannen und Bandanlagen). VDI (Ver. Deut. Ingr.)

Richtlinien, no. 2095, 7p., Feb. 1963. 13 refs. Translated from German by M. Schneider, Israel Program for Scientific Translations, Jerusalem.
CFSTI: TT 68-50469/1

The generation of dustlike and gaseous emissions from ore sintering plants and the possibility of reducing flue dust and sulfur dioxide emissions are discussed. About 0.7% of total sinter production is lost as flue dust, while the total amount of the sulfur dioxide content of sintering plant waste gas is about 0.4 vol% (11.7 g SO3/cu m STP). The criteria for limiting dust-like emissions are the permissible pollutant deposition quantities in the area of the plant and the dispersal conditions given by stack height, neighboring emittents, orographic position, etc. Dust collection plants should be designed for a guaranteed value of 150 mg/cu STP of waste gas for normal operating conditions. In continuous operation, the dust content of sintering gas must not exceed 300 cu mg. Attainable total collection efficiency and clean dust content of centrifugal collectors in continuous operation are 75-95% and 0.400 g/cu m STP. For electrostatic precipitators, they are 98% and 0.150 g/cu m STP. concentrations of air pollutants above ground and the dust disposition on the ground can be reduced by high stacks, utilization of thermal plume rise, and high flue-gas exit velocity at the stack mouth.

6411 APTIC NUMBER 16140

Iwanaga, Mitsuji, Iwao Nakajima, and Michiteru Yamaguchi
STUDIES ON THE REMOVING PROCESS OF SO2, I. ON A SUBMERGED POROUS DUCT SYSTEM REMOVER. (Shinsui tako dakuto hoshiki ni yoru aryusan gasu jokyo ho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(6):353-358, June 15, 1967.

An apparatus for removing sulfurous acid gas from room air is described. In tests with air containing 0.25 to 490 ppm sulfurous acid, sulfurous acid was absorbed either by water or by mixture of water and hydrogen peroxide. In the latter case, sulfurous acid became sulfuric acid. In both cases, air was ejected from a porous duct submerged in water. Sulfurous acid was almost completely removed and costs were low. To lengthen the contact time of air with water, a board with a slight gradient was placed over the porous duct in water. Necessary pressure for a tank was 60 to 100 mm water. Even when two tanks were used, the running cost for the blower was not high. For air containing 2.46 ppm sulfurous acid, 283 min were required for the complete removal of the sulfurous acid by water containing no hydrogen peroxide, 566 min by water containing 32 cc hydrogen peroxide. When 100 cc hydrogen peroxide was added, the time for complete removal was 133 hrs, and the volume of cleaned air was 22,000 cu m. The cost was below 45 yen. The scrubbing water was neutralized with lime, etc. The present device is capable of almost complete SO2 removal from both polluted urban air and heavy-oil boiler flue gas.

6412 APTIC NUMBER 15966

Jodeck, Paul
METHOD OF SEPARATING SULPHUR DIOXIDE AND THE LIKE FROM LIQUID HYDROCARBONS. (Edeleanu GmbH, Berlin, Germany) U.S. Pat. 1,910,341. 4p., May 23, 1933. (Appl. Jan. 17, 1929, 4 claims).

A process for evaporating and recovering sulfur dioxide from mixtures of liquid hydrocarbons and SO2 is reported. A mixture is forced under sustained pressure through a series of alternate heating and separating containers. Sulfur dioxide gas is allowed to evolve in each heating container and is separated from the liquid in the following separating container. The remaining liquid is raised to a higher temperature in the next heating container. The gas is liquified as it evolves. This is cooled in another container while still under sustained pressure. The process has an important application for the refining of mineral oils, increasing the capacity of the refining plant and decreasing the cost of treatment.

6413 APTIC NUMBER 15861

Johnson, Ava J.
PROCESS FOR THE SEPARATION OF ACIDIC GASES FROM FLUIDS. (Shell Development Co., San Francisco, Calif.) U. S. Pat. 2,368,595. 8p., Jan. 30, 1945. (Appl. Aug. 29, 1941, 7 claims).

The invention describes process for removing acidic gases, such as H2S, CO2, HCN, SO2, found in natural gas, petroleum fractions, and coke oven gas from a water immiscible fluid. It deals especially with the purification of normally gaseous hydrocarbons containing objectionable quantities of H2S. The method consists of scrubbing the flowing fluid at an elevated pressure of 200-1000 pounds per square in. with a nonalkaline water. A portion of the acid gas is extracted by the nonalkaline water to form acidulated water and a first residal fluid. The acidulated water is separated from the first residual fluid. The residual fluid is then scrubbed with a lean base solution chosen from organic hydroxy amino bases or salts of inorganic strong bases and relatively weak acids of low volatility. Another portion of the acid gas is extracted to form a fat solution and a second residual fluid. The fat solution is separated from the fluid and refluxed with steam at a lower pressure to produce a vapor composed of acid gas, steam and a residual lean base solution for use in another scrubbing cycle. The acidulated water is stripped with steam vapor to vaporize the acid gas and condense water substantially free of the acid gas. The invention accomplishes a high degree of purification of fluid with a minimum expenditure of heat for regeneration of the absorption medium.

6414 APTIC NUMBER 15967

Johnson, James Yate
IMPROVEMENTS IN WASHING OUT GASEOUS WEAK ACIDS FROM GASES. Farbenindustrie (I. G.) A.-G., Frankfort, Germany and Cootts & Co., London, England) British Pat. 457,343. 16p., Nov. 26, 1936. (Appl. May 21, 1936, 5 claims).

A process for purifying gases containing weak acids consists in scrubbing the gases with alkaline-reacting solutions of salts of amino and imino acids or tertiary N-acids which are derived

from a primary, secondary, or tertiary amine containing at least two nitrogen atoms. The preferred amines are ethylene diamine and its polymers. The acids can be derived from the amino compounds in any manner. Nitrogeneous acids, which are especially suitable, are used in the form of their salts. Appropriate salts are the alkalies and alkaline earths or organic bases containing several nitrogen atoms. By varying their components, the absorptive power of the washing solutions can be varied as required. The washing liquids can be used to purify practically all industrial gases containing gaseous weak acids. These gases include coke-oven gases, natural gases, gases formed from the conversion of coals or hydrocarbons with air, oxygen, or steam, combustion gases, and gases derived from the therml splitting of hydrocarbons. A special advantage of the process is that deposits of solid substances do not take place during the washing of gas or the regeneration of the washing liquids. Washing can be carried out in packed towers or mechanically moved washers.

6415 APTIC NUMBER 15824

Johnstone, Henry F.
PROCESS FOR REMOVING AND RECOVERING SULPHUR DIOXIDE FROM WASTE GASES. (Illinois Univ., Urbana, Board of Trustees) U. S. Pat. 2,082,006. 5p., June 1, 1937. (Appl. April 10, 1933, 18 claims).

A process for the recovery of sulfur dioxide from flue gases and industrial plant gases was invented. This process is not limited to these waste gases but is applicable for use in connection with smelter gases and others. The waste gases are washed with a spray of cooled water which removes the dust and sulfur trioxide. The gases are then introduced into a scrubber where they are subjected to a counter-current flow of an aqueous solution. The solution contains a salt of a sulfanilic acid, ammonium sulfite, and an oxidation inhibitor. The ionization constant of the solution is such that the ratio of the ionization constant of sulfurous acid to the ionization constant of the acid salt decreases with temperature increase. The gas solution mixture is collected at the bottom of the scrubbing tower. It is then passed through a heat exchanger which is placed in the path of the regenerated solution on its way to the scrubber. The regenerated solution is cooled and its heat is absorbed by the gas solution. The absorbed sulfur dioxide is released from the gas solution mixture by heating, which causes a change in the ionization constant of the sulfurous acid. The water vapor which may be present in the liberated sulfur dioxide is condensed. The gas passes through driers and purifiers to a compressor, where it is condensed and compressed into cylinders.

6416 APTIC NUMBER 16456

Johnstone, H. Fraser and Alamjit D. Singh
THE RECOVERY OF SULPHUR DIOXIDE FROM DILUTE WASTE GASES BY CHEMICAL REGENERATION OF THE ABSORBENT. Ill. Univ., Eng. Exp. Sta., Bull., 38(19):137p., Dec. 31, 1940. 106 refs.

A process for the recovery of sulfur dioxide from dilute waste gases is described. An estimate was made of the type and size of equipment required for a plant recovering 21.7 tons of SO2 per day from stack gases containing 0.3% SO2. The installed cost of equipment was estimated to be $140.000 (1940) and the fixed charges and operating costs would amount to $1.08 per ton of coal burned. The advantages include a clear liquid of high absorption capacity and precipitation of scale-forming salts which takes place outside the scrubber. The aqueous absorbing solution is composed of the sulfites of the non-volatile base, sodium hydroxide, so that there is no danger of loss of chemicals by volatilization. The principal product of the process is pure SO2. The most serious difficulty lies in the oxidation of the circulated materials which produce sulfates which must be removed from the solution. An improved method of desulfation was described which depends on returning a part of the recovered SO2 to a portion of the circulated solution, and then removing sulfate with lime. This was not feasible for gases containing less than 0.3% SO2. Straight neutralization would be substituted for the recovery process for SO2 between 0.3 and 0.1%. A clear sodium sulfite solution would be circulated through the scrubber. Regeneration and removal of sulfate would be accomplished outside the scrubber by means of lime, and sufficient time for crystallization would be allowed so that scaling of the scrubber surfaces would be impossible. The possibility of commercial development of the recovery process depends on economic factors. It was concluded that large scale development will occur as new uses are found for SO2. (Author summary modified)

6417 APTIC NUMBER 16208

Juentgen, Harald and Joachim Karweil
METHOD FOR DESULFURIZATION OF FLUE GASES. (Verfahren zur Entschwefelung von Rauchgasen). Text in German. (Bergwerksverband GmbH., Essen) W. German Pat. 1,261,166. 3p. Feb. 15, 1968. 4 refs. (Appl. Aug. 23 1963, 1 claim).

For desulfurization of flue gases by catalytic oxidation and separation of the obtained sulfur oxides with carbon-containing adsorbents, SO2 is oxidized to SO3 in the gaseous phase on solid conventional catalysts (activated coal excepted). Preferred catalysts are platinum or vanadium. The obtained SO3 is conventionally adsorbed in a second stage on carbon-containing adsorbents. The process is illustrated by the following example. A flue gas branch from an oil-fired furnace with 0.13% by volume SO2 was passed over a platinum catalyst at 450 C. The residence time was 1.4 sec; 95% of the SO2 was converted. Subsequently, the gas passed with a speed of 20 cm/sec at 150 C through a coke bed. The loading capacity of the catalyst was 25% by weight. In a comparative experiment without previous oxidation to SO3, the loading capacity was 1.3% by weight.

6418 APTIC NUMBER 14454

Kadota, Masaya
THE EFFECT OF THE FOREST BELT ON REDUCTION OF AIR POLLUTION. (Rintai ni yoru Taikiosen Keigen Koka.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6(1): 24-28, April 1968. 7 refs.

The sulfur and fluorine contents of the leaves in an air-polluted area are extremely high compared with those of a non-polluted area. For the purpose of air purification by means of a forest, those so-called 'evergreen flat leaves,' such as chinaberry trees, are most suitable, since these trees are most resistant to sulfur dioxide. However, as these trees grow slowly, it is advisable to plant rapidly-growing ones like black pines meanwhile. The distribution of the polluted air differs greatly and involves many factors. Therefore, it is not sufficient to attempt to reduce pollution by means of plants alone. Applied microbiological and physiochemical methods should be developed. If the forest belt is adopted as a tool in reducing air pollution, it should be established in areas where polluted air contacts the ground. In determining the size of the green belt, factors such as the quality and quantity of the polluted gas, air stream, temperature, etc. must be considered. If the green belt is located close to the factory an area ten times as large as the factory area may be needed to obtain optimum results.

6419 APTIC NUMBER 16145

Kakutani, Fujizo
A CLEANING DEVICE FOR AUTOMOBILE EXHAUST GAS. (Jidoshayo haikigasu seijosochi). Text in Japanese. (Fuji Carbon Industries, Tokyo) Japanese Pat. Sho44-17681. 2p., Aug. 4, 1969. (Appl. July 30, 1966).

In a new invention for purifying automobile exhaust gas, the exhaust is mixed with air and oxidized while passing through a porous, tubular catalyst. The tube is made from powdered silver suboxide, cuprous oxide, and platinum black. Volatile granules are added to the powders, which are kneaded together with a caking agent such as Bakelite or tar pitch. After being shaped into a tube, the catalyst is baked in a vacuum to carbonize the caking agent and make the tube porous. The electrical resistance of the catalyst has a negative temperature coefficient. At both ends of the tube, electrical terminals are provided to apply voltage to the tube. By applying voltage the catalyst is quickly heated to a working temperature because of its negative temperature coefficient. When the temperature is reached, a circuit breaker switches off the current. When exhaust gas contains a large amount of carbon, it is passed through an adsorption filter made of activated charcoal before entering the catalyst.

6420 APTIC NUMBER 16179

Kamino, Yasumi, Shigenori Onitsuka, and Kenji Yasuda
RECOVERY OF SULFUR DIOXIDE FROM FLUE GASES BY THE ACTIVATED CARBON PROCESS USING STEAM DESORPTION. (Suijoki datsuir shiki kasseitanho ni yoru endo haigasu chu no aryusangasu no kaishu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(5):291-297, May 15, 1968. 5 refs.

Among the dry methods of desulfurizing flue gas, the Reinluft process of adsorption with activated charcoal is the most famous. Disadvantages of this method are the oxidation of the adsorbent during the separation process and wear due to the movement of the absorbent. These disadvantages are overcome by using a high-cost activated charcoal in combination with steam in the initial phase of separation. The use of steam at a comparatively low temperature reduces the amount of activated charcoal lost in the separation process. Since the charcoal adsorbs double or triple the amount of sulfurous acid adsorbed by cokes, the size of the equipment required for desulfurization is reduced. The new method yields high concentrations of pure sulfurous acid. Activated charcoals used experimentally were AC-Q, AC-GS, AC-S, and AC-C, of which AC-Q was the most effective. Experiments in which it was used are described in detail. The adsorption rate of sulfurous acid is 10.1 to 20.8 sulfurous acid per activated charcoal. When 1140 gr of sulfurous acid were adsorbed, 1103 gr were removed. The investment cost of the method for a 25 million kwh generating plant is three million dollars; the operating cost is about 1.5 dollars per ton of heavy oil.

6421 APTIC NUMBER 16186

Kato, Tsutomu
AIR POLLUTION PREVENTER. (Kukiosen boshizai). Text in Japanese. (Daiichi Carbon Industries, Fukuroi City, and Tanachi Electrical Industries, Tokyo) Japanese Pat. Sho44-22173. 3p., Sept. 22, 1969. 2 refs. (Appl. April 7, 1965).

A granular adsorbent for carbon monoxide in automobile exhaust gas is described. The invention is an improved version of a method which had limited application for high-temperature exhaust gas because of its high operating temperature (200-300 C). The present adsorbent oxidizes CO below 50 C and has a wider application. Natural zeolite is dipped in dilute hydrochloric acid solution and dried until activated. Ten parts of the processed powder are blended with six or seven parts of a manganese oxide powder that is precipitated from an acidic solution of salts with four or three parts of copper oxide powder that is precipitated from an alkaline solution of salts. The mixture is pressed to granules of 5 mm diameter. To test the product, 8 l of the adsorbent were placed in a cleaner installed at the exit of an exhaust-gas muffler of an automobile with 4 cylinders of 1200 cc capacity. After running tests of 5000, 10,000, and 20,000 km, the remaining percentages of CO were 5%, 10%, and 20% respectively. The design target was 30%. The granules can be used for more than a year without renewal.

6422 APTIC NUMBER 15946

Ketov, A. N., V. V. Pechkovskiy, V. V. Larikov, and A. S. Shligerskiy
DRY LIME METHOD OF REMOVING SULFUR DIOXIDE FROM POWER PLANT FLUE GAS. II. INDUSTRIAL TESTS. (Sukhoy izvestkovyy sposob ochistki topochnykh gazov tets ot sernistogo angidrida. Proizvodstvennyye ispytaniya). Text in Russian. Izv. Vysshikh. Uchebn. Zavedenii, Energ. (Minsk), no. 2:84-89, 1969. 3 refs.

A gas purifying arrangement patented by the authors has been tested under industrial conditions. The degree of SO2 removal was

found to increase with lime consumption rate, and reached 60-78% with lime in amounts of 120-140% of stoichiometric values. When lime powder is introduced into the boiler fire box, the dew point drops from 348 to 333 K depending upon the amount of chemosorbent. Greatest purification was achieved with frontal jets (inclined to 25 degrees) and with a combination of frontal (inclined to 15 degrees) and lateral (at 0 degree) jets. The introduction of lime into the fire box has no noticeable effect on its operating characteristics or on the heating surface.

6423 APTIC NUMBER 16233

Kingston Chemicals Ltd.
MANUFACTURE OF NITROUS OXIDE. APPENDIX II. Brit. J. Anaesthesia, vol. 39:443-444, May 1969.

Production of pure nitrous oxide by the closed circuit method is described. Ammonium nitrate is liquified in a preheating retort by gas cylinders and then transferred to the main retort which is heated only until the nitrate is able to generate its own heat. The pressure in the main retort pushes gas through a purification system, eliminating the risk of impurities being entrained in the system. After partial cooling, the gas is scrubbed with caustic soda and passed through beds of finely divided iron where nitrogen dioxide is removed and nitric oxide reduced to nitrous oxide. The gas is then passed through sulfuric acid, a water scrubber, and is dried by lump caustic before entering a gasholder designed to balance the rate of gas produced and the rate of gas compressed. From the compressors the gas passes through another bed of finely divided iron and additional lump caustic. It is liquified by cooling. The cylinders to which the liquid is passed are overfilled by approximately six pounds of liquid and allowed to stand before being 'blown back' to the required weight. This eliminates the more volatile impurities: nitrogen and nitric oxide.

6424 APTIC NUMBER 16157

Kipot, M. S., A. I. Brodovich, and B. S. Filippov
REMOVAL OF NITRIC OXIDE FROM COKE-OVEN GAS. Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), no. 3:38-43, 1969. 47 refs.

Although the amount of nitric oxide in coke-oven gas is small, even the slightest trace reduces the efficiency of equipment for fertilizer manufacture and creates the risk of explosion. Current methods of nitric oxide removal are those that involve compression of coke-oven gas or those that are carried out at normal pressures (800-1000 water guage). When the compression method is carried out in hollow reactors, 70-90% of the nitric oxide can be removed at 100 C and 10-12 atm. When carried out with molybdenum or tungsten sulfide catalysts, nitric oxide is virtually entirely removed at 180-250 C and 16 atm. The best available method for removing nitric oxide from uncompressed gas is purification in electrostatic brush-discharge precipitators. In this process, nitric oxide is oxidized inside the precipitator, on an almost stoichiometric basis, to nitrogen dioxide. The nitro-resins formed by the reaction of the nitrogen dioxide with the unsaturated hydrocarbons present in the gas are speedily deposited inside the precipitator. The nitric oxide content of the coke-oven gas is reduced from 0.5 to 0.006 ppm. This method should receive further study in the Soviet Union where the introduction of smokeless coke has increased the nitric oxide content of coke-oven gas.

6425 APTIC NUMBER 16108

Kirsh, A. A., I. B. Stechkina, and N. A. Fuks
INVESTIGATIONS OF FIBROUS AEROSOL FILTERS: EXPERIMENTAL DETERMINATION OF THE EFFICIENCY OF FIBROUS FILTERS IN THE REGION OF MAXIMUM PARTICLE BREAKTHROUGH. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 31(2):181-185, March-April 1969. 7 refs.

A method is proposed for calculating the efficiency of polyester fiber filters and glass filters in the region of maximum particle breakthrough. The degree of structural nonuniformity as determined by the hydrodynamic resistance of the filters is considered. Good agreement is obtained between experimental capture coefficients for these filters and coefficients predicted by a model for fan filters. The ratio of the capture coefficients for the model filter and a real filter of the same packing density, under the simultaneous influence of diffusion, accretion, and inertia, is equal to the ratio of the hydrodynamic forces per unit fiber length in them. This ratio can be used to assess filter nonuniformity.

6426 APTIC NUMBER 16139

Kiyoura, Naisaku
ABATEMENT OF AIR AND WATER POLLUTION IN PETROLEUM INDUSTRY (PART II). URGENCY OF DEVELOPING DESULFURIZATION METHODS. (Sekiyu kogyo ni okeru kogai bojo taisaku (sono II). Datsuryu gijutsu kaihatsu no kinkyusei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(5):310-316, Dec. 15, 1965.

Problems associated with the desulfurization of petroleum are discussed. Criteria for a hydrogen sulfide removal method are a high collection rate and purity of the obtained sulfur, ease and safety of the operation, and reasonable construction costs. The universal method for the removal of hydrogen sulfide is Claus method based on the partial oxidation of hydrogen sulfide to sulfur. To collect hydrogen sulfide, the Girbotol process, which has a good desulfurization rate, is used. In this process, exhaust gas is passed through an aqueous amine solution which absorbs acid gas. The purified exhaust gas is released to the atmosphere, and the amine solution regenerated to release the acid gas. To prevent the aqueous amine solution from generating pollutants, a part of the solution is successively distilled in the amine regenerator. To collect sulfur, one-third of the hydrogen gas is heated with a chemically equivalent amount of air to produce sulfurous acid. The sulfurous acid reacts with the remaining two-thirds of the hydrogen sulfide to produce sulfur. The gaseous sulfur produced is condensed to liquid. Excessive air decreases the temperature and make the operation difficult. Exhaust gas after sulfur collection contains sulfurous acid of

1.5 to 2.6 percent. A more practical desulfurization method is on the point of development.

6427 APTIC NUMBER 16545

Kiyoura, Naisaku
ABATEMENT OF AIR POLLUTION CAUSED BY SULPHUR DIOXIDE IN JAPAN. (Juyu no chokusetsu datsuryu oyobi haigasu datsuryu ni yoru taiki osen taisaku no jikkosei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(10):2-17, Oct. 15, 1966.

As a result of economic growth, air pollution has become a serious danger in Japan. There are two technical countermeasures: direct desulfurization of heavy oil and desulfurization of exhaust gas. An economic method of heavy oil desulfurization is desirable, but a 30% increase in costs is normally unavoidable for 75% desulfurization. Exhaust gas from a sulfur recovery plant where the heavy oil is desulfurized contains far more sulfur dioxide than the usual petroleum refinery plant. Therefore, desulfurization of exhaust gas is an urgent question. Sulfur dioxide concentrations exceeded 0.2 ppm in Tokyo 89 times in July 1966 and zero times in July 1964. At Isozu in Yokkaichi city, they exceeded 0.2 ppm 40 times in July 1964 and 123 times in July 1966. Countermeasures taken in Yokkaichi city decreased sulfur dioxide concentration. In contrast, Tokyo is expected to have a pollution episode as severe as any experienced in London within 10 years unless proper countermeasures are achieved. The present technology forecasts 4 to 8% concentration by 1975. Some wet methods for exhaust gas desulfurization have been put into practice. Because these methods decrease exhaust gas temperature dry methods are now being investigated. These include the Reinluft, alkalized alumina, Pennsylvania electric generator plant and Tokyo Kodai Kiyoura processes.

6428 APTIC NUMBER 15984

Kolganov, V. A. and L. V. Nadushkevich
NATURE OF SECONDARY PROCESSES IN THE FILTRATION OF AEROSOLS. REPT. NO. 2. PRELIMINARY DATA OF THE STUDY OF CAPILLARY PHENOMENA IN FILTERS. (Priroda vtorichnykh protsessov pri fil'tratsii aerozoley. Soobshcheniye 2. Predvaritel'nyye dannyye izucheniya kapillyarnykh yavleniy v fel'trakh). Text in Russian. Izv. Akad. Nauk Arm. SSSR Khim. Nauk, no. 6:1208-1214, June 1967. 6 refs.

Filters were soaked in water at room temperature and then carefully dried at 40 C to a constant weight. Dibutylphthalate and boiled vegetable oil served as nonvolatile liquids. A polydispersed polystyrene aerosol with a known distribution of particle sizes was used in the test (test method described in an earlier paper). It was found that a combination of different liquids reduces the effectiveness of fibrous filters. A decrease in selectivity of the filter for particle sizes 0.1 to 0.6 micron is noted while selectivity in general is maintained. The effect of a nonvolatile film is greater, the more complete the emersion in water. Test results may be explained by the influence of various capillary effects resulting from absorption of the liquids. Preliminary analysis indicates that all capillary effects which might be expected must lead to undesirable changes (with respect to filtration) in the film leading to a reduction in its degree of dispersion and to an increase in film nonuniformity.

6429 APTIC NUMBER 16430

Kolodkina, L. A. and N. N. Nechaeva
OXIDATION OF SULFUR DIOXIDE IN A HIGH VOLTAGE ARC DISCHARGE. (Okisleniye sernistogo angidrida v dugovom vysokovol'tnom razryade). Text in Russian. Zh. Fiz. Khim., 7:845-53(1933). 3 refs.

An increase in current strength increased the percentage of sulfur dioxide oxidized in a high voltage discharge. An increase in the length of the arc significantly increased the yield of sulfur trioxide. Conducting the entire mass of the gas through the arc discharge, other conditions remaining the same, did not increase the percentage oxidation of sulfur dioxide, but the equilibrium was attained sooner. A decrease in the rate gas flow increased oxidation of sulfur dioxide, which attained 100% at a rate of 0.25 l per min. A decrease in the sulfur dioxide concentration also increased oxidation. Thus at 0.2% sulfur dioxide and a rate of 1 l per minute, the reaction went to 100% completion.

6430 APTIC NUMBER 16628

Kostin, V. M.
HYDRAULIC RESISTANCE OF SPRAYED CHECKERWORK WITH UNIFLOW MOTION OF GAS AND LIQUID. (Gidravlicheskoye soprotivleniye oroshayemoy nasadki pri pryamotochnom dvizhenii gaza i zhidkosti). Text in Russian. Khim. Prom. (Moscow), no. 10:11-13, 1964. 12 refs.

The static pressure drop was measured in a simulated checkerwork-type uniflow gas scrubber, as commonly used for catching dust present in industrial gases in concentrations of, typically, 1 to 10 gram/cu m, as mm.H2O of air flowing at a mean speed between 0.5 and 4 meter/sec across a checkerwork formed of a 0.2 meter or a 0.8 meter thick layer of randomly oriented Raschig rings of 15, 25, or 35 mm (nominal) outer diameter resting on a grid inside the column and wetted with water at a wetting rate between 0 and 40 cu m/(sq m. hr). The static pressure drop in mmH2O across a 1 m thick Raschig-ring layer, if the supporting grid were absent, was calculated approximately by multiplying by 5/3 the difference of the pressure drop values for the 0.8 and 0.2 m thick layers under otherwise identical test conditions. The values determined when the wetting rate was equal to 0 were in good agreement with the formula of N. F. Zhavoronkov.

6431 APTIC NUMBER 15846

Koto, K.
REMOVAL OF SULFUR DIOXIDE FROM EXHAUST GAS. (Haigasu chu no aryusan gasu shori-ho). Text in Japanese. (Toa Gosei Chemical Industry Co., Japan) Japanese Pat. 174,880. 2p., June 6, 1948. (Appl. Dec. 28, 1943, claims not given).

The coal dust and inorganic compounds (SiO2, Fe2O3, Al2O3, CaO) resulting from coal gas production are used to remove sulfur dioxide gas from factories engaged in sulfuric acid manufacture. This coal dust is activated by the high temperature, oxygen, and steam, and shows a tremendous adsorptive power for SO2. In addition, the inorganic compounds included in large amounts with the coal dust (40.23 to 57.96%), neutralize the SO2 present in the water. Thus, 600 l of coal dust is homogenized with 1.7 l of water and is scattered inside a cylinder in which SO2 (0.7% of the total exhaust gas) passes at the rate of 135 cu m/min. The washed exhaust gas includes only 0.04% of SO2 at a temperature of 12 C. The coal dust can be used in this procedure for 48 hrs.

6432

APTIC NUMBER 14453

Krane, Dieter
EMISSION PROBLEMS IN CHICKEN FARMS. EXPERIENCES WITH THE ELIMINATION OF DISAGREEABLE ODORS. (Emissionsprobleme durch Huehnerfarmen. Erfahrungen ueber die Beseitigung schaedlicher Geruchsstoffe.) Text in German. Wasser Luft Betrieb, 12(8): 482-483, Aug. 1968.

High-temperature drying of chicken excreta usually leaves disagreeable odors due to decomposition of various nitrogen-containing organic substances, mainly proteins, amines, and albumins. Proteins are not heat-resistant and begin to decompose at temperatures as low as 100 C. Thus, any odor-preventing drying method must operate at temperatures below 100 C. Since none of the conventional methods such as afterburning, decomposition by bacteria, ozonizing, etc. operates odorlessly, a new method has been developed. The installations necessary for the drying of the excreta comprise a sheet steel trough in which a bundle of pocketed pipes slowly rotates. The heaters installed in the pipes develop pipe wall temperatures of no more than 140 C so that the manure itself never gets any warmer than 70 C. The liquid material slowly moves on in the trough while constantly being turned. The fumes are caught by an exhaust fan. The excreta is granulated in the dryer to grains of 1 to 3 mm diameter. The dried material is blown into a storage bin. Since the fine parts of the dried excreta are the odor carriers, they are eliminated in a wet scrubber. The separated particles are returned to the wet excreta at the entrance of the dryer.

6433

APTIC NUMBER 16536

Kurosawa, Keiji
ENRICHED AIR COMBUSTION OF HARD-TO-BURN REFUSE. (Toshi jinkai shokyaku ni taisuru sanso riyo ni tsuiteno ichi kosatsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(11):771-773, Dec. 1966. 1 ref.

Enriched air combustion of refuse has advantage, though investment costs are high. Oxygen lowers the ignition temperature. Nitrogen decreases combustion smoke with no loss of heat. The higher the flame temperature, the less the odor of combustion smoke. Reduced smoke makes it easy to remove smoke dust. Wet and watery refuse can be burnt with savings in heavy oil. The combustion smoke remaining inside the incinerator burns more refuse in the same incinerator in an equivalent period of time than other combustion methods. The oxygen content of air is only 21%, the remaining 79% consisting of nitrogen and argon. A large proportion of combustion heat in the air is used to heat the nitrogen. Since refuse in Japan is generally more watery than that in western countries, more heavy oil is needed as a subsidiary fuel. Oxygen application reduces the heavy oil consumption for refuse incineration. Present equipment for separating oxygen from air by liquefaction reflects great technological progress. A 10,000 cu Nm/h capacity can be found in some iron and steel works, or petroleum industry plants. Construction expenses are estimated to be approximately 80 to 90 billion for 95% O2 at 10,000 cu Nm/h.

6434

APTIC NUMBER 16184

Lang, Ludwig
AN APPARATUS FOR CLEANING THE EXHAUST GAS OF AN INTERNAL COMBUSTION ENGINE. (Nainenkikan no haikigasu o jokasuru sochi). Text in Japanese. (Paul Heintz Fitteler, Germany.) Japanese Pat. Sho44-20525. 8p., Sept. 3, 1969. 1 ref. (Appl. Sept. 7, 1966).

With conventional cleaners for engine exhaust, difficulties arise in activating the catalyst at low temperatures and keeping the temperature constant without overheating the catalyst. The present invention provides a solution to these problems of catalytic exhaust gas. Exhaust gas is injected with air before reaching the catalyst chamber which consists of two nozzle units, one a blender and the other the catalyst housing. The catalyst is formed into a basket shape. Its upstream side is covered with a stream-lined thin, solid shell without a hole, its downstream side with a shell with grooves or holes. One converging passage is provided around the catalyst along the inner wall of the chamber and another converging channel provided along the center line of the catalyst. The end of the channel is partially or totally closed. The device is a key to the present invention and is a kind of improved bypass system. The catalyst oxidizes both carbon monoxide and unburnt hydrocarbons. When the engine speed is low, e.g., below 60 km/h, the mixture of air and gas is lead through the catalyst. When the speed is high, the gas mixture is bypassed around the catalyst, since the catalytic reaction is not required at high temperatures.

6435

APTIC NUMBER 16291

Lastochkin, Yu. V., I. P. Mukhlenov, I. G. Lesokhin, Ye. S. Rumyantseva, and T. P. Bondarchuk
OXIDATION OF SULFUR DIOXIDE IN AN ARRANGEMENT WITH A PSEUDO FLUIDIZED BED OF IRON OXIDE CATALYST UNDER CONDITIONS OF CONTACT-TOWER PRODUCTION OF SULFURIC ACID. (Okisleniye sernistogo gaza v apparate s psevdoozhizhennym sloyem okisnozheleznogo katalizatora v usloviyakh kontaktno-bashennogo proizvodstva sernoy kisloty). Text in Russian. Khim. Prom. (Moscow), 42(6):45-48, 1966. 4 refs.

Optimum conditions for sulfuric acid production in a pseudo fluidized bed of an iron oxide catalyst were studied on both a laboratory and industrial scale. Data indicated that, with a sulfur dioxide content of 12% at an optimum temperature of 680-700 C, there is a sharp rise in catalyst productivity with an increase in volumetric gas flow rate. With a constant linear gas flow rate, there is a resultant decrease in hydraulic resistance of the system and an increase in the volumetric flow rate, at the same time, a minimum required degree of preliminary oxidation is assured. Increasing the volumetric flow rate also reduces catalyst consumption to five times below existing systems using vanadium catalysts.

6436 APTIC NUMBER 16715

Leithe, W.
REPORT ON METHODS FOR THE REMOVAL OF SULPHUR DIOXIDE FROM FLUE GASES. Chem. Engr. (London), 221:CE262-263, Sept. 1968. 4 refs.

This report to the Working Party of the European Federation of Chemical Engineers presents a brief look at the state of the art of methods for the removal of SO2 from flue gases. A comparison is presented of the major characteristics of the Reinluft, Sulfacid, Aluminate, Catalytic H2SO4, and Mitsubishi processes.

6437 APTIC NUMBER 16501

Leone, P.
RECOVERY AND USE OF SULFUR DIOXIDE IN THE SULFUR EXTRACTION PROCESS. (Ricupero ed utilizzazione dell'anidride solforosa nel processo di estrazione dello zolfo). Text in Italian. Ann. Chim. (Rome), 21:238-244, 1931. 5 refs.

A procedure is proposed for converting sulfur-bearing gases into hydrochloric acid and chlorine gas by passing the sulfur dioxide over sodium chloride heated to 450-500 deg. The context of the proposal is directed toward the island of Sicily in the early 1930's, where the production of sulfuric acid from SO2 is considered unprofitable, and from where the cost of transporting such products as calcium sulfite and calcium bisulfite is considered prohibitive. Two chemical reactions are involved: sodium chloride, sulfur dioxide, water, and oxygen react to form sodium sulfate and hydrochloric acid; and sodium chloride, sulfur dioxide, and oxygen react to form sodium sulfate and chlorine gas. Both reactions are strongly exothermic. The HCl is to be used in dissolving limestone gangue; the Na2SO4, to enrich minerals with sulfur by way of increasing their sulfur yield; and Cl gas, in the manufacture of calcium chloride.

6438 APTIC NUMBER 16716

Lindau, Lars
COSTS FOR DUST ARRESTORS ON CUPOLAS IN SWEDEN. Air Eng., 11(1): 20-22, Jan. 1969. 3 refs.

This report of the National Swedish Conservancy Office summarizes their studies of the cupola problem. The investigations have been concentrated on the costs of air pollution equipment and some typical data are presented. Emissions, temperatures, gas volumes and similar data are presented as critically examined literature values. Finally, a recommended emission standard is reported.

6439 APTIC NUMBER 16214

Lord, G. Ross and Hans J. Leutheusser
WIND-TUNNEL MODELLING OF STACK GAS DISCHARGES. Preprint, 19p., 1968. 6 refs. (Presented at the Banff Pollution Conference, Banff, Alberta, Canada, May 15, 1968.)

Relatively simple wind-tunnel tests are required to determine with confidence the minimum heights of chimneys and stacks which will prevent the occurrence of aerodynamic down-wash of gaseous effluents. Under a simplified model law applicable to such tests, buoyancy can be neglected or approximated by momentum effects, and velocity appears as the only significant similitude parameter. Similarly, the otherwise strict requirement for geometric similarity between model and prototype can be relaxed by requiring only similitude of the gross configuration of buildings and structure. Added to these factors, the ease of detecting and correcting critical conditions makes wind-tunnel modeling of stack gas discharge a powerful tool in controlling air pollution from chimneys and stacks. (Author conclusions modified)

6440 APTIC NUMBER 15813

Lunde, K. E.
PERFORMANCE OF EQUIPMENT FOR CONTROL OF FLUORIDE EMISSIONS. Ind. Eng. Chem., 50(3):293-298, March 1958. 12 refs. (Presented at American Chemical Society, Division of Analytical Chemistry, Symposium on Air Pollution, Joint with Division of Industrial and Engineering Chemistry and American Chemical Society Committee on Air Pollution, 130th Meeting, Atlantic City, N. J., 1956.)

Metallurgical, heavy chemical, fertilizer, and ceramic processes discharge fluorides to the atmosphere as hydrogen fluoride, silicon tetrafluoride, or solid fluorides of varying composition and particle size. The efficiency of various equipment for controlling these emissions is evaluated for purposes of minimizing capital investment and operating costs. Absorption data are reported in terms of the number of transfer units and related to liquid and gas flow rates, which are expressed in terms of theoretical power consumed per unit of gas flow rate. The absorption of gaseous fluorides is analogous to the absorption of sulfur dioxide and the relative performance of equipment should be similar. It is shown that the number of transfer units obtainable on grid towers is controlled principally by tower height and is only slightly affected by power expended on the liquid and gas phases. The performance of cyclone spray scrubbers is primarily a function of power expended in the liquid phase, while the performance of venturi scrubbers depends on the power expended in the gas phase. These factors dominate the performance of equipment used in the absorption of gaseous fluorides. Various spray towers exhibit

significant differences in performance. Wet-cell washers require a higher power consumption than simple spray towers. In designing spray towers, the removal of silicon tetrafluoride by scrubbing with water should not be considered a case of simple gas absorption. In the case of silicon tetrafluoride, mists formed in the tower are collected primarily in entrainment separators just prior to emergence from the tower. The mist is presumably rather coarse because jet scrubbers do not exhibit substantially better performance than the low-power-consuming spray towers. To be efficiently collected by separation, the mist should be 10 microns or larger. Adequate data are not available to evaluate the performance of equipment for collecting particulate fluorides. However, the performance is probably controlled largely by the total power consumption of the device and design of equipment is of relatively unimportant. (Author summary modified)

6441 APTIC NUMBER 16500

Mactaggart, E. F.
SULPHUR RECOVERY FROM STACK GASES. A REVIEW OF CURRENT PRACTICE. Ind. Chemist, 16(190):323-324, 328, Nov. 1940.

Processes for removing sulfur from power station combustion gases and from smelter gases are summarized. When by-product recovery is not desired, sulfur can be economically removed from power plant stack gases by washing the gases with water. At one power station, 80-90% sulfur removal was obtained by preliminary washing with water followed by the passage of the gases through a suspension of chalk in water. In the case of smelter gases, reduction to sulfur is of interest when the concentration of sulfur dioxide in the metallurgical stacks does not exceed two percent. As a general rule, it is first necessary to concentrate the sulfur dioxide by a process such as the Ciba, or Sulphidine, process, wherein the sulfur dioxide is absorbed by a xylidine-water mixture, which forms a homogeneous liquid when the concentration of sulfur dioxide is more than 100 g/l. On heating to 80-100 C, sulfur dioxide is evolved. Any sulfate formed remains in aqueous liquid from which it is removed by sodium carbonate. The xylidine, free of sulfur dioxide, is cooled and returned to the system.

6442 APTIC NUMBER 16350

Maksimov, V. F., O. I. Sokolova, Z. P. Modzelevskaya, and N. M. Isayeva
PURIFICATION OF THE WASTE GASES OF SULFATE-CELLULOSE PRODUCTION ON FOAM TYPE UNITS. Bumazhn. Prom. (Moscow), 34(5):14-16, May 1959. 2 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 8p.

Experiments were conducted on the decontamination of exhaust gases in sulfate-cellulose production by the foam method, based on the interaction of a gas and liquid in a layer of moveable foam formed as a result of their counterflow. It involves the purification of gases from the plant furnace, concentrator, and boiler units. When the gas flow rate of the foam device was varied from 0.4 to 3.2 m/sec, the purification of furnace gases was constant and amounted 92-95% (based on total sulfur). After purification, 10-40 mg/cu m hydrogen sulfide, 8-46 mg/cu m methyl mercaptans, and 3-120 mg/cu m sulfur dioxide were present in furnace flue gases. Decontamination of the boiler gases removed 92% of the hydrogen sulfide, 90.7% of the methyl mercaptans, and 86.0% of the sulfur dioxide. When the simultaneous decontamination of exhaust gases from furnace, concentrator, and boiler sections was studied, using caustic soda as a wetting liquid, 92.3% of the hydrogen sulfide, 84.7% of the methyl mercaptans, 86.6% of the dimethyl disulfide, 72.8% of the dimethyl sulfide, and 89.9% of the sulfur dioxide were trapped. When black lye was used as the wetting agent in an oxidation tower, no odor of sulfur-laden gases was detectable.

6443 APTIC NUMBER 16561

Massinon, J.
ATMOSPHERIC POLLUTION AND STEEL MAKING. (Pollution atmospherique et siderurgie). Text in French. Rev. Soc. Roy. Belge. Ingrs. Ind. (Brussels), no. 6/7:333-343, 1969. (Presented at a Conference of the Belgians Royal Society of Engineers and Industrialists, May 7, 1969.)

The efforts made at the national level by numerous organizations engaged in fighting atmospheric pollution are reviewed. The general sources of air pollution, their relative importance, and their actions are examined. The measures taken by the steel-making industry to reduce industrial emissions are reported in considerable detail, and the remaining technical difficulties are pointed out. The pertinent legislative measures in Germany, France and Belgium are likewise discussed in detail, and desirable future developments are pointed out.

6444 APTIC NUMBER 16353

Maura, Giancarlo and Fausto Pochetti
ADSORPTION OF H2S AND CO2 ON POLYAMINOALKYLOL RESINS. (Adsorbimento di H2S e CO2 su resine poliaminoalchiloliche). Text in Italian. Nuova Chim (Rome), no. 4:47-55, Nov. 1969. 11 refs.

The polyaminoalkylol resins, which contain activated radicals similar to those of the alkanolamines used to eliminate acid gases from industrial gas mixtures, are capable of adsorbing notable quantities of H2S and CO2 gases. The resins can be regenerated with alkaline solutions or with superheated steam. The adsorption equilibrium under various conditions of temperature and acid-gas concentration is studied in comparison with other anion-exchanging resins of the conventional type. The high performance of the resins is seen only in the treatment of gases near room temperature, since the adsorption decreases sharply with increases of temperature. Three types of resins were tested: strong anionic, of the polystyrene type, cross-linked with 8% divinylbenzene, with activated N-benzyl-trimethyl radicals; weak anionic, of the polyamine type (aminophenol-formaldehyde copolymer) with activated amine and quaternary ammonium radicals; and chelating, of the polystyrene type (4% divinylbenzene) with activated N(CH2COOH)2 radicals. The

capacity of the polyaminoalkylol resins is comparable to that of the liquid alkanolamines of the Girbotol process, except that regeneration of the resins is a slower process than that of the amines. A major application of the resins would be in cases where it is necessary to eliminate small quantities of acid constituents from large volumes of gas.

6445 APTIC NUMBER 15957

Mel'nik, M. N.
MEASURES FOR SANITATION OF ATMOSPHERIC AIR IN THE UKRAINE. (Meropriyatiya po ozdorovleniyu atmosfernogo vozdukha na Ukraine). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities. (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p. 17-18.

Control measures instituted at cement plants in Dneprodzerzhinsk and Krivorozhsk have given significant reduction in quantities of dust emitted into the atmosphere. The ore enrichment combine at Krivorozhsk was provided with dust control equipment which resulted in a substantial recovery of iron. Effective gas purification measures at the Kramatorsk Metallurgy Plant and at the Zaporozhstal Martensite Furnace No. 2 are also reported. Failures at pollution control have occurred at some locations, especially in the Donbass, because the actual efficiency of control equipment has been significantly below the design values, or else already existing pollution sources were not adequately accounted for.

6446 APTIC NUMBER 16206

METHOD FOR ADSORPTION OF SO2 FROM SO2 LADEN GASES. (Verfahren zur Adsorption von Schwefeldioxyd aus schwefeldioxydhaltigen Gasen). Text in German. (Metallgesellschaft A G, Frankfurt/M.) W. German Pat. 1,165,556. 2p. Aug. 20, 1964. (Appl. Sept. 4, 1962, 4 claims).

A method (is described) for the adsorption of SO2 by low-temperature cokes and the subsequent regeneration of the adsorbent by heating. The coke is preferably produced from mineral oil or from acid sludge at low temperature (350 C). The latter type of coke is particularly suitable for this purpose. It contains 7% sulfur and comes in small spheres. With low temperature coke (weight 860 g), adsorption per 100 ccm coal is 4.3 g, with acid sludge coke (weight 840 g), the adsorption per 100 ccm coal is 6.7 g. This is in contrast to peat coke (weight 400 g) which adsorbs 3.1 g per 100 ccm coal.

6447 APTIC NUMBER 15864

PROCESS OF TREATING INDUSTRIAL COMBUSTIBLE GASES. (Metallgesellschaft A G, Frankfurt, Germany) British Pat. 901,272. 15p., July 18, 1962. (Appl. Oct. 14, 1959, 6 claims).

A process is described for treating industrial heating gases produced by the degasification or gasification of fuels. The purpose of the invention is to recover the substances that are scrubbed out of the crude gas e.g., carbon dioxide, hydrogen sulfide, lower hydrocarbons, and organic sulfur and nitrogen compounds. The gases are scrubbed above 10 atm and below 0 C with organic, polar, water-soluble absorbents, preferably methanol and acetone. The low-temperature scrubbing process divides the gases into insoluble portion which consists of permanent gases and a soluble portion which is recovered during the regeneration of the absorbent in the form of gases and vapors. The regeneration process consists of scrubbing the washed crude gas below 0 C in three stages with an absorbent whose temperature decreases from stage to stage in the direction of the gas flow. Each stage has a circulating system for its own scrubbing liquor, including the regeneration of the absorbent. The regeneration of the absorbent in the first stage is performed by low temperature separation, in the second stage by two distillation columns, in the third stage by the stepwise decompression and occasional heating of the absorbent. During the regeneration of the absorbent, methanol vapor and hydrogen sulfide are separated from the light end hydrocarbons in an aqueous alkaline scrubbing liquor and concentrated in relation to CO2.

6448 APTIC NUMBER 16359

Metcalfe, T. B.
INHIBITION BY HYDROGEN SULFIDE OF THE HYDRODESULFURATION OF PETROLEUM PRODUCTS. (Inhibition par le sulfure d'hydrogene de la reaction d'hydrodesulfuration des produits petroliers). Text in French. Chim. Ind. (Paris), 102(9):1300-1303, Nov. 1969. 2 refs.

The most commonly used method for desulfurization of petroleum compounds is the treatment by hydrogen or a cobalt-molybdenum catalyst packed column. Unfortunately, this catalytic reaction is poisoned by the hydrogen sulfide produced by the reaction. The kinetics of this reaction were established. It was shown that the rate of hydrogenation of the sulfur compounds contained in petroleum is of the first order with respect to the sulfur concentration. Inhibition by hydrogen sulfide is well represented by the Langmuir adsorption isotherm. (Author abstract modified)

6449 APTIC NUMBER 16248

Miller, D. M. and James Jonakin
KANSAS P & I TO TRAP SULFUR WITH FLUE-GAS SCRUBBER. Elec. World, 169(10):35-36, March 4, 1968.

An air pollution control system now being installed in a coal-fired power plant comprises a limestone injection and wet scrubbing system guaranteed to remove 83% of the sulfur dioxide and 99% of the particulates from flue gas. In addition, about 20% of the nitrogen oxides will be removed. Limestone, injected in a furnace at a rate of about 185 lb per ton of coal, will be calcined into a more reactive compound that combines with all the SO3 and a portion of the SO2 to form calcium compounds. The flue gas passes through an air preheater to the scrubber where the remaining SO2 and fly ash will be removed. Compounds resulting

Design considerations, field tests, and actual field experience of a new catalytic purifier for diesel exhaust gas are discussed. Based on an analysis of temperature, pressure and available space limitations a precious metal catalyst on a unitary ceramic support has been developed as an optimum design for a diesel exhaust purifier. Many installations on diesel powered fork lift trucks and mining machinery, monitored weekly, have shown consistent oxidation of contaminants including CO during load cycles even after 7500 hr of operation. At idle mode where temperatures are below 200 F odoriferous acroleins, aliphatic aldehydes etc. were oxidized whereas catalytic oxidation of carbon monoxide was no longer effected. This purifier is also being evaluated on large stationary diesel powered electric generators. For maximum advantage the catalytic system should be considered in the initial design of the diesel engine rather than being designed as a "hang-on" device as it is today. (Author's Abstract)

6455 APTIC NUMBER 16366

Muermann, Herbert
DUST REMOVAL FROM FLUE GASES OF CENTRAL HEATING PLANTS. (Rauchgasentstaubung in Zentralheizungsanlagen). Text in German. Wasser Luft Betrieb, 12(1):11-13, Jan. 1968.

For the removal of dust in central heating plants, new two or four cyclone units have been constructed. They are of standard size with capacities of 1600 cu m/hr (two-cyclone unit) and 3200 cu m/hr (four cyclone unit). Several of these units can be combined to obtain the capacity required for each individual case. At nominal load and a flue gas temperature of 200 C, the pressure loss is 120 mm water. The entire height of the unit including the dust bin is just 2175 mm. Each unit has its own dust bin with a volume of 100 liters. They are sled into the units and closely interlocked so that no dust can escape. A diagram is given with which the adequately sized dust separator can be selected. The entire dust separation system comprises the separator which is directly connected to the boiler, a ventilator, flexible connecting pipes, baffles, and flue gas ducts. Larger dust separation systems catering to several boilers, the dust may be pneumatically transported to a common paper bag where the entire dust is collected.

6456 APTIC NUMBER 15637

Muhlrad, M. Wolf
CEMENT PLANTS AND ATMOSPHERIC POLLUTION. PROBLEMS OF DUST REMOVAL. (Les cimenteries et la pollution atmospherique. Les problemes de depoussierage). Text in French. Equipement Mecan., 48(87):91-95, 1969.

Cement plants have the most formidable dust removal problems among industrial dust and smoke emission sources. The centrifugal, the wet, the electrostatic, and the screen filtering, methods of dust separation are described in detail; dust sources and the dust collecting equipment used in the individual successive stages of cement production are considered. Quarrying limestone in open air gives rise to moderate quantities of dust, which are sometimes sprayed with water. Pounding and crushing limestone calls for the use of multitubular centrifuges followed, if need be, by screen filters. Wet crushing produces no dust, while dry or semi-dry crusing requires high-capacity, fine-mesh, movable screen filters. Electrostatic filters are occasionally used instead. Homogenizing requires limited dust removal. Drying and crushing of coal pose difficult dust removal problems due to the danger of coal-dust explosions. Smoke from roasting kilns is the primary source of dust. Particle size distributions and concentrations of dusts from six kinds of roasting kilns are given in a Table. Most modern kilns are provided with electrostatic filters. Clinker cooling uses dust centrifuges. Clinker crushing sometimes uses electrostatic filters but, more commonly, bag filters with movable screens. Automatic cement bagging machines usually have movable screen filters made of nylon. At present, no satisfactory solution of the problem of dust removal in cement plants exists, so that the establishment of new cement plants should still be based on considerations of dispersal of dust emissions in the atmosphere.

6457 APTIC NUMBER 16630

Muschelknautz, Edgar
STUDIES OF CENTRIFUGAL SEPARATORS. (Untersuchungen an Fliehkraftabscheidern). VDI (Ver. Deut. Ingr.) Ber., no. 115: 124-128, 1967. 7 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 17p., Sept. 23, 1969.

Cyclones are used for separating solid particles from gases, although smaller and less expensive facilities would to the same job. The annular slot separator is illustrated and its operating principle is described. Water canal experiments were performed for the design of the annular slot separator; stream lines and particle paths are illustrated. Experiments with a small model separator (diameter 125 mm) at which the slot width of the conical rings could be changed, were performed and results as function of the collection efficiencies for certain particle sizes are tabulated. With an annular slot separator made of spring wire, which has a mean slot width of 1 mm, a total collection efficiency of 95% was obtained with the same dust. Very narrow slots around or below 1 mm are permissible only with dusts which have no tendency to adhere. The deflection separator is illustrated. The air is deflected at the end of the tube conveyor by 180 deg with the aid of secondary air. By the centrifugal movement of about 30,000 m/sec imparted on the air, all particles are thrown out, despite the very short residence time (only several ms). Particle size collection efficiency of a deflection separator with air injection into the boundary flow is tabulated.

6458 APTIC NUMBER 15951

Nakada, Taichi, Chosaku Nakasone, and Yoshio Goromaru
DUST COLLECTOR FOR THE BLAST FURNACE. (Nippon Kokan Co, Tokyo) (Yohromo no rojoh syuhjin sohci). Text in Japanese. Japanese Pat. Sho44-12250. 4p., June 3, 1969. (Appl. Dec 28, 1966).

Dust is usually removed from blast furnace exhaust gas by filtering the gas through a raw material vessel. Conventional filter vessels are installed independently on an electric furnace or incorporated in the material chute; the exhaust gas is introduced to the bottom of the vessel and passed through lower part to upper part. Because the height of the material is the total height necessary to filter the dust effectively and to discharge material to the furnace, the ventilation resistance is large: the power required is excessive. Moreover, because of the small filter area, the quantity of gas to be handled is small. To solve these problems, the present invention employs a new route of exhaust gas so that the direction of falling material crosses that of the flow of exhaust gas at a right angle. The material vessel is composed of concentric inner pipe and outer pipes, the space between them is filled with the material. An opening small enough to prevent the material from flowing out is prepared at the bottom of the tubes. The inner and outer pipes have many side openings to let the exhaust gas pass through from the inner to the outer pipe. The lower part of the space between the two tubes is broadened so that the material can move down smoothly. If the layer exceeds a certain thickness, the ventilation resistance increase. However, the thickness of this layer for filtering is always constant and the ventilation resistance is small. The filter area can be increased if necessary.

6459 APTIC NUMBER 16553

Narikawa, Hiroshi and Toshitaka Tsutsumi
ON THE SOOT IN TOPGAS OF OIL INJECTION BLAST FURNACE. (Juyu fukikomi koro no rocho dasuto chu susu ni tsuite). Text in Japanese. Kogai to Taisaku, (J. Pollution Control), 1(2):102-104, June 15, 1965.

New techniques in iron manufacturing involving the use of liquid or granular fuel have increased production efficiency but created a soot problem. As the result of incomplete combustion of heavy oil, the topgas in an oil injection blast furnace contains a large quantity of soot. The amount is closely related to the quantity of heavy oil and combustion conditions. The quantitative measurement of the amount is important for the improvement of the process and the control of emissions. Quantitative measurements at several stages of the process, together with investigations of gas cleaning efficiency, were evaluated. The measurements included the quantity of soot in topgas, the change of soot quantity due to the change of operation, the effect of various kinds of soot removers, and the amount of soot remaining in the gas after application of the soot removing process. The gas cleaner comprised a dust remover, venturi scrubber, and electric dust collector. The soot quantity of the topgas under good combustion condition was 11%, while under poor combustion conditions is was 28.5%. The soot quantity at the outlet of the electric dust collector was 91% under stable conditions and 97.8% under unstable conditions. The soot removal rate of the venturi scrubber was 40 to 60%; that of electric dust collector, 98% under stable conditions, but only 77.5% under unstable condition.

6460 APTIC NUMBER 15933

POLLUTION-ABATEMENT TECHNOLOGY: APPENDIX 5 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 181-202, 1966.

The technology required to reach acceptable levels of water, land, and air pollution is considered. At the present time, improvement in water pollution control could be achieved by wider application of available technology. As better criteria are developed, and stricter standards set, there will be need for improved technology. Thus, research and development must be continued so that the improved technology for the future is available. Although the technology of burning many types of materials is well developed, both domestic and municiple incinerators need to be upgraded in efficiency. The effluent from municiple incinerators contains about 15 pounds of particulate and about five pounds of undesirable gas for each ton of waste burned. Disposal of solid wastes by sanitary landfilling represents an irretrivable loss of land areas and adversely affects the ecology of swamps and tidal lands. Since land pollution is closely related to both water pollution and air pollution, work on its abatement must avoid creating the other kinds of pollution. Primary sources of air pollution are automobiles and fossil-fueled power plants. Metropolitan areas are now approaching pollution levels that will not permit further expansion of power generation without effective control equipment. The cost of transporting power from distant plants may be less than the cost of installing and operating such equipment. Because of engine designing modifications, long-range abatement of air pollution from automobiles is in sight.

6461 APTIC NUMBER 15934

THE DELAWARE RIVER BASIN REGION. APPENDIX 8 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 237-251, 1966.

The Delaware River Basin, comprising the 11-county area on both sides of the Delaware from Trenton to Wilmington, is discussed in terms of residue loadings, its political barriers, and the interactions of waste handling and disposal with the environment. To simply the complex problem of air pollution, residue loadings with and without abatement action, and the costs of control techniques, are approximated by a simple 'primary pollutant-primary emitter' model that considers only critical pollutants and critical emitters. From these approximations, costs are computed for direct-flame afterburners for motor vehicles, the alkalized alumina process for removing sulfur dioxide from power-plant flue gas, a sewage treatment facility to remove biological oxygen demand from municipal and industrial wastes, a cooling tower for utility effluent, and the disposal of refuse by incineration or landfilling operations. Comparative cumulative cost curves are presented for the policies considered.

6462 APTIC NUMBER 16061

Macklin, T. and B. M. Holland
REMOVAL OF HYDROGEN SULPHIDE FROM COKE OVEN GAS BY THE STRETFORD PROCESS. Dechema Monograph, 48(835-858):243-271, 1963. 13 refs.

The stretford process was developed to remove hydrogen sulfide from all types of gas streams. It is important because of the high labor costs of the oxide box operation and the poor return from spent oxide sales. The Stretford process is also important because a continuous liquid purification system to produce pure sulfur was needed. The sodium salts of anthraquinone disulfonic acids (ADA) will absorb hydrogen sulfide from a gas stream in an alkaline solution. The reduced solution is oxidized by the air. The use of vanadate with ADA improves the rate of oxidation of hydrosulfide to sulfur. The vanadate is reoxidized by ADA and the reduced ADA is regenerated by air. The rapid conversion of hydrogen sulfide to sulfur ensures a low formation of thiosulfate. At the working pH for coke ovens gas, less than 1% of the sulfur was converted to thiosulfate. The sulfur is produced in a fine suspension which is concentrated by froth flotation on top of the oxidizer. It is then filtered, washed, and autoclaved to give a high purity molten product. In this form, the value of the sulfur is double that of the equivalent quantity of spent oxide and is produced in a plant almost half the cost of the oxide box system to purify a given gas stream. (Author summary modified)

6463 APTIC NUMBER 14447

Norman, J. H. and D. G. Wood
SULPHUR DIOXIDE REMOVAL FROM FLUE GASES WITH POROUS METAL OXIDES. Inst. Engrs., Australia: Mech. Chem. Eng. Trans., MC-4(1):118-122, May 1968. 8 refs.

Manganese oxides and alkalized alumina were investigated as absorbents for the SO2 found in flue gases. It was found that the reaction between manganese oxide and air-SO2 mixtures follows a simple kinetic equation. Also the reaction was not limited by gas film mass transfer or pore diffusion, provided that small pellets and moderate temperatures were employed. However, manganese oxide is relatively expensive to produce, and its use can only be justified if the makeup rates of new absorbent are small. It is believed that the structure, porosity and surface area of the alkalized alumina pellet are important in determining the rate of reaction. This process appears to be the most promising because elemental sulfur is recovered as a by-product. The metal sulfate, formed in the reaction with SO2, is changed back to the oxide by a reducing gas. This reaction produces H2S, which is removed in the regenerator effluent for recovery as elemental sulfur. Of the problems still associated with this process, one of the most urgent is the development of a cheaper, more effective solid absorbent.

6464 APTIC NUMBER 16316

Nu-way Eclipse Ltd., England, Technical Engineering Staff
INCINERATION OF EFFLUENT VAPORS. Metal Finishing J. (London), 15(180):434-436, Dec. 1969.

Direct-flame fume incinerators should meet the most stringent regulations for the control of solvent emissions from processes, such as paint drying and stoving, printing, lithographing, curing, and polymerizing. In these units, organic pollutants are passed through a combustion chamber, raised to self-ignition temperature by contact with the direct flame, and oxidized to carbon dioxide and water. The temperature to which effluent gases must be raised for the combustion reaction to produce a sufficiently pure gas will vary according to type of pollutant, percentage of exhaust pollutant allowed, and the degree to which effluent and flame are mixed in combustion. In general, exhaust-gas discharge temperatures of 1200-1400 C reduce pollution in effluent by 85-95%. The discharge to the atmosphere is odor-free. The fume-elimination process cannot be used with certain degreasing solvents such as halogenated organic compounds.

6465 APTIC NUMBER 16090

Ohlmeyer, Manfred and Wolfram Stotz
AIR FILTER INSTALLATIONS FOR SEPARATION OF SUBSTANCES HIGHLY INJURIOUS TO HEALTH. (Luftfilteranlagen zur Abscheidung hochgradig gesundheitsschaedigender Stoffe). Text in German. Wasser, Luft Betrieb, 13(4):111-116, 1969. 3 refs.

Air filters loaded with radioactive, infecticus, or toxic substances must be absolutely tight to prevent any leaks, and the casing must be resistant to underpressure. The filter cells are replaced by attaching a plastic sack to the casing to avoid contaminating the surrounding area; a new procedure is illustrated which permits the sack to fit tightly with the filter. The loaded filter cells are vacuum-packed in plastic sacks which are then sealed by welding. The underpressure is usually 150 to 300 mm water. The filter must be simple to clean and have a corrosion-resistant interior. The casings for such filters are nowadays exclusively made of sheet steel with special protective coating. Once the filter has been begun operation it should not be opened again, in order to prevent expensive decontamination of the entire room by a special decontamination squad. It is suggested that the first filter stage be loaded from above as is usually done, while the last one should be loaded from below. This prevents dust from falling into the section of the cleaned gas during replacement procedures. A method is described for checking the filter for leaks, in which an oil mist is injected into the filter which precipitates in it when there is no leak but which becomes visible at the outlet as an oil streak if there is a leak. A strong light source and a black background are required.

6466 APTIC NUMBER 16331

Ohlmeyer, Manfred and Wolfram Stotz
AIR FILTER SYSTEMS FOR THE COLLECTION OF HIGHLY DANGEROUS SUBSTANCES. (Luftfilteranlagen zur Abscheidung hochgradig gesundheitsschaedigender Stoffe). Text in German. Wasser Luft Betrieb, 13(4):111-116, 1969. 3 refs.

Tightly sealed filters must be used for the collection of radioactive, infectious, or toxic substances. The casing must

withstand an underpressure maintained in the interior. At present, they are made of sheet steel. The spent filter cells are vacuum packed into a plastic sack, the opening of which is then tightly welded. The sack fits tightly into the opening of the filter casing. A specially profiled groove guarantees safe removal. The new filter cell must be pressed into its frame so that its efficiency is not decreased. This demand is at present still very difficult to fulfill. Any leak of the filter casing requires high costs for decontaminating the filter room. It is recommended to collect the dust with the upward directed side of the filter at the first stage with the side facing the bottom at the last stage. This prevents collected material from falling onto the cleaned gas side. After each filter replacement, the tightness of the filter must be checked. For this purpose oil droplets with diameters of less than 1 micron are injected. If the filter is tight, mist is collected by the filter; if there is a leak, an oil streak becoses visible at the outlet.

6467

APTIC NUMBER 16510

Padovani, C.
SULFUR DIOXIDE EMISSIONS FROM LARGE HEATING PLANTS: PROBLEMS AND SOLUTIONS. PART II. (Emissione di ossido di zolfo delle grandi centrali termiche: problemi e soluzioni. Parte II). Text in Italian. Riv. Combust., 22(7/8):389-396, July-Aug. 1969. 65 refs. Part I. Ibid, no. 5, 1968.

The following fuel oil desulfurizing plants are under construction or in the planning stage: H-oil unit of 28,000 barrels/day at Shinoiba, Kuwait; an Isomax plant, 35,000 b/d at Mina Abdullah, Kuwait; and an Isomax plant, 40,000 b/d in Chiba, Japan. The economic problem of providing low-sulfur fuel oil in Europe differs from that of the United States in that there is a greater demand for gasoline and medium-to-light distillates and a higher demand for heating oils, a condition to be eventually offset by increasing demands for light petroleum products in petrochemistry, increased use of motor vehicles, and greater availability of natural gas. Future projects call for preliminary gasification under pressure, which can lead to the formation of hydrogen sulfide gas. Hydrogen sulfide liberated from the gasified fuel is more easily captured than SO2 in the exhaust gases, and lends itself more readily to the manufacture of elemental sulfur to be sold as a by-product. Gasification provides a fuel gas that can be highly varied in composition, with almost no additional expenditure of power. By making use of the chemical and physical enthalpies of these gases, the yield of the modern heating plant can be raised by 5-15%, plus compensations from the sale of by-products.

6468

APTIC NUMBER 16250

Parker, William Clifford and Hubert Clarke
FULHAM BASE-LOAD POWER STATION: MECHANICAL AND ELECTRICAL CONSIDERATIONS. Inst. Civil Eng. J. (London), vol. 9:17-36, 1938. 2 refs.

The design, construction, and operation of a large municipal coal-fired base-load power station are discussed in detail. Attention is focused on the gas washing plant for extracting sulfur dioxide from flue gases. The gas is washed with river water containing lime and other alkalies. In early experiments, the sulfur dioxide was neutralized by the lime and precipitated as a mixture of calcium sulfite and calcium sulfate, the latter crystallizing when formed at concentrations greater than saturation. Crystallization is now prevented by maintaining a suspension of gypsum crystals in the washing medium. When more than five percent of gypsum crystals is suspended in a liquor, which commences in a highly saturated state, the supersaturation falls to nothing within almost one minute. In practice, a delay period of three and one-half minutes is allowed between cycles of the recirculating liquid, so that the presence of the suspended crystals effectively prevents any supersaturation existing in the washing liquid from entering the packed scrubbers. Flue gases are generally as low as 0.0006 grain of sulfur per cu ft. Only traces of dust having a size less than five micron pass out with the exit gases to the atmosphere.

6469

APTIC NUMBER 16191

Parkes, Deric William and Richard Brealey Evans
ABSORPTION OF ACIDIC GASES. (Robinson Brothers Ltd., Oldbury, Great Britain) U. S. Pat. 2,106,435. 3p., Jan. 25, 1938. (Appl. Jan. 16, 1937, 11 claims).

A process was invented for removing an acidic gas such as hydrogen sulfide, carbon dioxide, or sulfur dioxide from a gaseous mixture. The gaseous mixture is passed through an aqueous solution which consists of one of the dipiperidyls and their homologues. The absorbed gas is freed by heating the mixture and adding water at intervals to prevent charring. Industrial applications of this process include the recovery of carbon dioxide for the production of liquid and solid carbon dioxides, the removal of carbon dioxide in certain hydrogenation processes where the hydrogen is recirculated, removal of carbon dioxide from coal gas, and the rapid removal of carbon dioxide from the atmosphere in enclosed spaces where oxygen is being used.

6470

APTIC NUMBER 16564

Petrov, N. M. and L. F. Kuznetsova
STATISTICAL CHARACTERISTICS AND THE STABILITY OF SO2 OXIDATION PROCESS IN A CONTACT APPARATUS WITH STATIONARY ADIABATIC CATALYST LAYERS AND INTERSPACE HEAT EXCHANGERS. (Staticheskiye kharakteristiki i ustoichivost' protsessa okisleniya SO2 v kontaktnykh apparatakh s nepodvizhnymi adiabaticheskimi sloyami katalizatora i promezhutochnymi teploobmennikami). Text in Russian. Khim. Prom. (Moscow), no. 11:29-35, 1969. 14 refs.

Statistical methods to determine the stability of a process of sulfur dioxide oxidation is described. The mathematical derivation of the conditions of stability of the process is given. The effect of different parameters on the stability of the process is discussed in terms of parametric sensitivity of the process (the change of final temperature of the gas with the change in temperature of the gas entering a catalyst layer). The method enables the determination of conditions necessary to

guarantee stability of stationary processes in both simple and complex contact systems with a large number of feedbacks; the determination of threshold operating conditions; and it supplies information on controllability of a technological process. The values of statical characteristics are important when choosing the construction and controlling design of the contact unit determined for conversion of gases of varying composition, where sufficient static stability of the process and ability of the apparatus to guarantee stable temperature regime in any region of SO2 concentration changes are required.

6471 APTIC NUMBER 15887

Pettit, Grant A.
ELECTRIC FURNACE DUST CONTROL SYSTEM. J. Air Pollution Control Assoc., 13(12):607-609, 621, Dec. 1963. 14 refs. (Presented at the 56th Annual Meeting of APCA, Detroit, June 9-13, 1963.)

Problems encountered in operating a venturi scrubber to clean waste gases from an electric steelmaking furnace are described. In accordance with state regulations, water clarification and recycling equipment is an integral part of the gas cleaning system. When the pH of the clarified water recycled to the scrubber is maintained at 7.0-7.6 with soda ash and the suspended solids content of the water kept at about 125 ppm with Seperan, the scrubber satisfactorily cleans gases at a water flow rate of 550 gpm and a pressure drop of 28 in. However, the efficiency of the system is reduced by plugging of the spray holes by solids. These holes are difficult to clean, since cyclinder-driven jet reamers often fail to go through them. In addition to the plugging, fine particles accumulate on large surface area, making frequent sludge filtration necessary. The sludge is filtered on a two-disc vacuum filter at an overall filtration rate of 20 lb wet sq ft/hr; cotton duck is used for filter bags. The average sludge analysis is 35% Fe, 9.5% Cr, and 2.5% Ni.

6472 APTIC NUMBER 16159

Piatt, W. R.
SUBMARINE ATMOSPHERES AND AIR POLLUTION. Scientiae, 104(687):358-374, 1969. 9 refs.

The development of air purification and oxygen replenishment systems for submarines is reviewed. The absorption of carbon dioxide, which constitutes about 1% of submarine atmospheres, was usually accomplished by soda lime in the 1920's and by lithium hydroxide in the 1930's and 1940's. Even today these are the preferred absorbents when logistics permit replacement of used cannisters or when submergence is less than two weeks. Regenerative monoethanolamine must be used during the extended submergence of nuclear submarines. Carbon monoxide concentrations are kept within threshold limit values by catalytic hydrogen burners, which also burn most of the hydrocarbons present. Since the major source of hydrocarbons in submarines are paints, it is advisable to refrain from painting for a month prior to and during submergence. Of other trace contaminants, methane is most resistant to catalytic combustion. Its sources are refrigerator gases and septic systems. Other sources of gases include solvents, lubricating oils and greases, medicines, diesel fuel, shaving lotions, and chemical fluids. By controlling the quantity of these items, the contaminants are kept to a few ppm at the most. On submarines oxygen is provided by electrolytic generators that decompose water into oxygen and hydrogen. Electrostatic precipitators remove most of the aerosols from smoking and other sources, and filter some of the other aerosols and adsorbable gases. The equipment is discussed in terms of its application to open atmospheres.

6473 APTIC NUMBER 16601

Plit, I. G.
ATOMIZING SCRUBBER-DECARBONIZER. (Pul'verizatsionnyy skrubber-dekarbonizator). Text in Russian. Khim. Prom. (Moscow), no. 8:61-64, 1966.

An atomizing scrubber for absorbing carbon dioxide from coke gas by an aqueous solution of KOH requires very low power for a high-output operation. It consists of a vat, filled to a certain level with the KOH solution, surmounted by a coaxial hollow cylinder 2 to 3 times its height, which is provided near its top with a stationary or centrifugal stripper and a coaxial atomizer. The gas inlet duct passing through the vat bottom terminates there and is formed of two coaxial tubes, one inside the other, with cone-shaped upper ends, extending from the vat bottom to slightly above the solution level and provided near its lower end with small openings and small horizontal tubes through which the KOH solution enters into, respectively, the outer and the inner atomizer tube. In operation, gas entering these tubes from the duct carries the solution along the walls of both tubes and up into their cone-shaped tips where the solution is atomized. In this highly dispersed state, the solution absorbs the CO2 from the gas during its rise in the hollow cylinder, until it is detained by the stripper, while the purified gas passes through it and leaves the scrubber through the gas outlet duct. The detained droplets of CO2-bearing KOH solution coalesce into larger drops and rivulets which return, in counterflow, to the vat. A laboratory model of this scrubber was used to study its effectiveness as determined by the kinetics of the absorption process, the effectiveness of the stripping process, and the power required to move the gas and the KOH solution through the atomizer. The effects of the CO2 content and speed in the atomizer tubes of the ga, the KOH content and temperature of the solution, the specific KOH-consumption as well as the degree of neutralization of the initial KOH solution, on the coefficient of CO2-recovery were determined. Graphs showing typical results obtained under specified conditions are given. The highest value of the coefficient of CO2-recovery attained in the model tests was 91%. A study of the stripping process showed that a 10 cm thick layer of 15 mm diameter, 15 mm high, 2 mm thick (Paschig) rings was 100% effective at gas speeds in the hollow cylinder of up to 0.5 m/sec. In a case when coke gas was scrubbed at a gas pressure of 12 atm and a gas speed in the atomizer of 50 m/sec and a specific KOH-consumption of 7 to 8 l/cu m, the flow resistance of the scrubber was found to be 1800 mm H2O.

6474 APTIC NUMBER 16260

Pozin, M. E., E. Ya. Tarat, L. Ya. Tereschenko, and I. N. Orekhov
ABSORPTION OF HYDROGEN SULFIDE BY ARSENICAL SODA SOLUTION UNDER TURBULENT (FOAM) CONDITIONS. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 39(8):1601-1607, Aug. 1966. 15 refs.

Investigations were undertaken of the rate and degree of absorption of hydrogen sulfide by arsenical soda solutions in a foam apparatus with sieve plates in order to establish conditions for purifying coke-oven gas. Empirical equations were derived to express the dependence of the coefficient of absorption on the gas phase velocity and foam height. These equations can be used in design calculations and to determine the influence of liquid-phase processes on the absorption rate. When hydrogen sulfide concentrations exceed a certain limit, the dissolution rate is higher than the neutralization rate, and the absorption rate diminishes sharply. Calculations show that for a given degree of hydrogen sulfide removal, the volume of the foam absorber needed is smaller in the ratio of 7.5 to 1 than the volume of a packed scrubber. A foam absorber with 13-18 trays is required to reduce hydrogen sulfide content in coke-oven gas to 1.5-2 H2S/cu m; one of 38 trays is necessary to reduce hydrogen sulfide to the permissible domestic level. The foam absorption process appears promising, since the rate of diffusional transfer of H2S from the gas to the liquid phase determines to a considerable extent the total rate of chemical absorption.

6475 APTIC NUMBER 16355

Pyopers, Franciscus Wilhem and Maria Mathias Johanes Jacob Stalman
A METHOD FOR REMOVING SULFUR DIOXIDE FROM A GAS MIXTURE. (Gasu kongobutsu kara nisankaiou o jokyo suru hoho). Text in Japanese. (Shell International Res. Co., The Hague) Japanese Pat. Sho 44-14212. 5p., June 24, 1969. 1 ref. (Appl. Oct. 1, 1964, claims not given).

The desulfurization of exhaust gas should not lower the temperature of the desulfurized gas; consequently, a method using a solid which absorbs sulfur dioxide is desirable. Although iron oxide itself is not suitable for the above objective an alumina carrier containing iron oxide besides alkali metal oxides is far more effective than that which contains no iron oxide. Also, antimony increase this capability, although neither it not its compounds can absorb sulfur oxide. A preferable temperature for the reaction is 250 to 300 C. The regeneration rate increases twofold by the addition of iron or iron oxide, and sixfold by the joint action of iron and antimony or their oxides. Regeneration takes place by an oxidizing gas at high temperatures of 500 to 700 C. Sulfur dioxide finally becomes sodium sulfate. Five kinds of carriers were investigated. The first consisted of sodium oxide; the second, iron oxide; the third, sodium oxide with iron oxide; the fourth, potassium oxide with antimony oxide, and the fifth, sodium oxide with potassium oxide, iron oxide, and antimony oxide. The quantity of the carrier necessary for absorbing one kilogram of sulfur and its regeneration ratio was 500 kg and 4.9% respectively for the first; 133.5 kg and 7.0% for the third; 66.7 kg and 42.9% for the fifth; and practically no absorption for the second and fourth.

6476 APTIC NUMBER 15845

Rafen, Wolfgang
EXCHANGE FLOOR OF DISTILLATORY TOWER. (Joryuto-yo no kokansho). Text in Japanese. (Assignee not given.) Japanese Pat. Sho42-16177. 4p., Dec. 12, 1967. (Appl. Oct. 8, 1966, claims not given).

Three exchange floors in a distillation tower were devised to distill such insoluble and/or pollutant substances as tar and pitch. Each floor has several small holes and each of these holes is covered by a dish with slightly larger diameter than that of the hole. There is a constant distance between the hole and the dish, and the dish is supported directly above the hole by three flat iron columns the width of which is less than one-sixteenth of the hole circumference. As the material drips from the vessel down to the first floor, it lands on the dishes and is dispersed within the first section of the tower and sufficiently mixed with the vapor ascending through the holes. A groove along the circumference of each dish collects pollutant substances before they drip onto the floor. The dish creates finer particles of the material and thus more efficient exchanges of material and heat are carried out. The free space under the dish prevents loss of vapor pressure as the vapor passes through the hole. There are three such floors and the material is almost completely distilled on these floors. Thus, this equipment provides a convenient and effective method of distillation.

6477 APTIC NUMBER 16205

METHOD FOR THE REMOVAL OF SO3 AND POSSIBLY ALSO OF SO2 FROM HOT GASES PARTICULARLY FROM COMBUSTION GASES. (Verfahren zur Entfernung von Schwefeltrioxyd und gegebenenfalls von Schwefeldioxyd aus heissen Gasen, insbesondere aus Feuerungsabgasen). Text in German. (Reinluft Gesellschaft mit beschaenkter Haftung, Essen) W. German Pat. 1,262,233. 5p. March 7, 1968. 1 ref. (Appl. July 31, 1958, 3 claims).

A process for removing SO3 from hot gases is characterized by adsorption of the SO3 on carbon-containing adsorbents at temperatures above the acid dew point of the gas to be cleaned, usually between 150 and 250 C. Charcoal, peat coke, or low-temperature coke, or activated coal can be used as adsorbents. The adsorbents require no preliminary treatment to increase their activity. They are regenerated by heating to between 300 and 600 C. Subsequent to SO3 removal, SO2 can be similarly removed. The adsorbents are circulated countercurrent to the gas flow. No SO2 is liberated from the adsorbent below 250 C. The advantage of this method is that the heat of the combustion gases can be utilized to a large extent without fear of corrosion or incrustation.

6478 APTIC NUMBER 16718

Renirez, Raul
DOUBLE-ABSORPTION GETS U.S. FOOTHOLD. Chem. Eng., 76(2):80-82, Jan. 27, 1969.

The first sulfuric acid plant in the Western Hemisphere to use a double-absorption process will soon be constructed. The process has been popular in Europe not only for its antipollution properties but also because the higher conversion (99.5%) results in attractive raw-material savings. However, installation and operating costs still appear to be substantially higher than for single absorption units. When sulfur erission control laws are enacted it is probable that single absorption plants now in existence will find it desirable to either convert to the double absorption process or improve the efficiency of the present installation. Some of the possible avenues open to improve the single absorption units are discussed.

6479 APTIC NUMBER 16041

Rosenblad, C.
RECOVERY OF HEAT AND SO2 GAS IN THE SULPHITE PULP INDUSTRY WITH OR WITHOUT HEAT EXCHANGERS. Paper Trade J., 106(26):78-81, June 1938. (Presented at the Annual Meeting of the Pulp and Paper Mill Superintendents Association, Toronto, June 22-24, 2938.)

Direct and indirect methods of heating the acid used in heat and sulfur dioxide recovery processes are contrasted. In the indirect system, relief gases from the digester are injected directly into the acid without intermediate cooling. The temperature and the concentration of the acid are difficult to regulate, since heating and strengthening take place simultaneously. In the indirect system, the acid is concentrated to full strength in cool condition by cooled gases from the digester relief and subsequently heated indirectly by the heat liberated when the digester is relieved and blown. No pressure tank is required during the concentration, and the relief of the digesters can be accomplished without any interference from back pressure. It is possible to obtain a final acid temperature higher than 156 F without using heat sources other than the relief steam and blow vapors. If a higher acid temperature is desired, digester temperature must be increased or additional heat added indirectly by a central acid heating system. In one condensing plant, part of the concentrated acid is heated in a relief cooler and the balance, in a spiral heat exchanger. The SO2 gases cooled in the condensing plant and relief cooler are taken to raw acid tanks and used for strengthening the acid. Though pressure tanks are used for the concentrated acid, they could be replaced by spiral heat exchangers.

6480 APTIC NUMBER 15862

Rosenstein, Ludwig
GAS PURIFICATION AND SEPARATION PROCESS. (Shell Development Co., San Francisco, Calif.) U. S. Pat. 2,368,600. 5p., Jan. 30, 1945. (Appl. Jan 24, 1942, 5 claims).

The invention increases the efficiency of processes for removing H2S, HCN, CC2, etc., from hydrocarbon liquids by reducing the amount of heat required for regeneration or by removing more inpurity from a spent solution with a given amount of heat. The fluid is contacted in a scrubber with a heat-regenerable absorbent solution to form a fat, or spent, solution which contains the impurities. The absorbent solution i.e., aqueous Na2CO3 or aqueous K3PO4, contains a solute which removes the impurities and a solvent which vaporizes above the boiling point of the impurities. The fluid is separated from the fat solution which is regenerated at reduced pressures for further scrubbing. The improvement in the invention comprises the regeneration of the fat solution in a primary stripper to produce a lean solution and vapors. The vapor is composed of gases from the solvent and impurities. A further portion of the lean solution is regenerated in a secondary stripper in indirect heat exchange with the vapors at a greater pressure than in the primary stripper. A secondary lean solution and secondary vapors are produced which also contain gases from the solvent and impurities. The vapors from both strippers are cooled to produce a condensed solvent and vapor containing the impurities. The solvent is separated from the vapor and added to the secondary lean solution. The lean solutions are put into the scrubber in a way that the fluid first contacts the primary and then the secondary lean solution. Fluids that can be scrubbed by the process include natural gas, refinery gas, coke-oven gas, smelter gas, other manufactured gases as well as liquid hydrocarbons.

6481 APTIC NUMBER 15840

Sagara, H., Atsukawa, M., and K. Kokubo
EQUIPMENT FOR THE REMOVAL OF SO2 GAS FROM EXHAUST GASES. (Haigasu chu no sankayuo o jokyosuru sochi). Text in Japanese. (Mitsubishi Heavy Industries, Ltd., Tokyo, Japan) Japanese Pat. Sho43-21847. 3p., Sept. 18, 1968. (Appl. Feb. 18, 1964, claims not given).

A combination of a dry sulfur dioxide absorption system (patented separately) and a dust collecting apparatus was designed as an improvement on the dry process. The MnO(OH) produced is continuously dispersed into the SO2-containing gas stream. The granules of manganous sulfate produced in the first step are collected by the dust collecting apparatus and sant to the MnO(OH) conversion equipment. A centrifugal system is required in the first step to accelerate the reaction rate, since the SO2 is heavier than the other gases and tends to collect on the MnO(OH) granules. There is a second dust collector charged with static electricity which enables it to collect granules in the smallest size range. This system provides for the circulation of both MnO(OH) and MnSO4 without any loss of reagent.

6482 APTIC NUMBER 16484

Salooja, K. C.
CONTROL OF AIR POLLUTION DUE TO PETROL ENGINES. Chartered Mech. Engr., 15(7):301-305, July 1968. 22 refs.

Four sources of major pollutants from vehicles are discussed. The exhaust accounts for 65%; the crankcase, 20%; and the carburetors and fuel tank, the remainder. Among engine design features, the fuel-air system has the greatest influence on the emission of pollutants. Fuel injection systems, although more expensive, eliminate the drawbacks of carburation. Variations in fuel composition have little influence on exhaust emission. The U. S. legal limits for carbon monoxide, hydrocarbons, and nitrogen oxides in exhaust gasses are given. Methods, such as the Man-air-ox system, of reducing CO as well as hydrocarbon pollutants are discussed. The most useful future developments will be those that improve the performance of the fuel-air induction system, the exhaust manifold, catalytic converters and after-burners. In addition, the concentrations of pollutants in the atmosphere of busy thoroughfares injurious to health must be determined.

6483 APTIC NUMBER 16719

Sargent, Gordon D.
DUST COLLECTION EQUIPMENT. Chem. Eng. 76(2):130-150, Jan. 27, 1969. 55 refs.

In solving a dust collection problem an engineer must first evaluate the situation in order to select the most promision types of collectors. This article puts together the available facts and sources that the engineer needs for background information. Gas-cleaning equipment discussed will handle dust particle sizes between 0.1 and 100 micron and concentrations from 0.1 to 100 gr/cu ft. The cost of treating a gas stream can be minimized by thoroughly engineering the whole system. Dust collectors are described and their attributes compared. Sampling and analysis techniques are discussed. Some cost data are presented.

6484 APTIC NUMBER 15843

Sasaki, S. and H. Ishikawa
MANUFACTURE OF ADSORBENT MUD FOR THE REMOVAL OF SULFUR COMPOUNDS FROM GASES AND LIQUIDS. (Kitai oyobi ekitai chuno yuo-kagobutsu jokyo-yo kodoshitsu-do-kei kyuchakuzai no seizo-hoho). Text in Japanese. (Assignee not given.) Japanese Pat. Sho42-24309. 5p., Nov. 22, 1967. (Appl. Sept. 25, 1965, claims not given).

Kanuma, Hiso, Awa, Osawa, and Imaichi muds which contain alumina silicate gels (alophen) as a main constituent, are purified and mixed with either pure activated charcoal in a 1:1 ratio or with a mixture consisting of 5-30% activated charcoal, 5-10% iron oxides, and 5-10% calcium hydroxide. The combined product is activated by heating at temperatures of 150-170 C for upwards of two hours. The compound forms a network of hydroxyl bridges which is resistant to water, acids, alkalis, and organic solvents. This product demonstrates a higher adsorption efficiency (0.27 g sulfur compounds per gram adsorbent) and continues to adsorb sulfur compounds for 210 hrs. The corresponding values for pure activated charcoal and untreated alophen are 0.16 g, 145 hrs. and 0.18 g, 172 hrs, respectively. Crude petroleum can be desulfurized by this method after 150 hrs of treatment at an efficiency of 72%. Other substances which may be desulfurized are crude ethylene, propylene, and LP gas, and water mineral or organic liquids produced by industrial processes.

6485 APTIC NUMBER 16612

Schenck, Rudolf
CATALYTIC ACTIVITY AND EQUILIBRIUM. (Katalytische Wirksamkeit und Gleichgewicht). Text in German. Z. Anorg. Chem., 260:154-60, 1949. 7 refs.

The activation energies for the oxidation of CO by activated CuO-Cr2O3 and nonactivated CuO were derived from kinetic measurements obtained by a previous investigator. It was found that the activation heat of the two catalysts is inversely proportional to the logarithm of the oxygen tension. In a catalytic oxidation the obtainment of a heterogeneous equilibrium between gaseous reaction partners and the solid phases of the contact is desirable. The effect of some catalysts with various log pO2 on the reactions 2CO plus O2 yields 2CO2, 2H2 plus O2 yields 2H2O, 2SO2 plus O2 yields, 2SO3 and CO plus H2O yields H2 plus CO2 is diagrammed.

6486 APTIC NUMBER 16341

Schischkov, D., M. Kojcharova, D. Ivanov, Z. Galunski, G. Dimov, K. Gruev, and D. Grueva
A STUDY OF THE CONVERSION OF CARBON MONOXIDE AND THE SIMULTANEOUS REMOVAL OF NITRIC OXIDE AND OXYGEN FROM THE SYNTHESIS GAS WITH THE AID OF LOW-TEMPERATURE CATALYSTS. (Studie ueber die Konvertierung von Kohlenoxid und die gleichzeitige Entfernung von Stickoxid und Sauerstoff aus Synthesegas mit Hilfe von Tieftemperaturkatalysatoren). Text in German. Allgem. Prakt. Chem. (Vienna), 20(3):68-70, 1969. 8 refs.

Tests with low-temperature catalysts developed by the Technological Institute of Sofia concerning the conversion of carbon monoxide were performed in an experimental plant with a capacity of 20 standard cu m per hour. The synthesis gas contained 88% hydrogen, 3.5% nitrogen and argon, 5.4% carbon monoxide, 2.5% methane, 0.6% carbon dioxide, up to 5 mg/hydrogen sulfide/cu m, 0.5 ppm nitric oxide, and 1000 ppm oxygen. The pressure at the activity tests was 28 to 29 atm gauge; the throughput speed, 2000 to 5000 cu m/cu m/hr; the steam/gas ratio, 0.5; and the temperature less than 250 C. With all types of catalysts tested, the same carbon monoxide concentration was obtained. The throughput speed exerts considerable influence at low temperatures on the residual carbon monoxide concentration; at higher temperatures, this influence becomes weaker. The catalysts were able to reduce nitric oxide and oxygen considerably, which means that they are able to convert and clean the synthesis gas in one process.

6487 APTIC NUMBER 16068

Schlachter, D. J.
REDUCTION OF STACK EMISSION THROUGH MODERNIZATION OF POWER

PLANT FACILITIES. Preprint, Andrew Jergens Co., Cincinnati, Ohio, 13p., 1963.

A company's power plant operations were modernized to meet new emission standards by replacing a pulverized fired boiler with a boiler fired by a spreader stoker with a continuous moving grate. To achieve smokeless combustion, the boiler was equipped with pneumatic combustion controls, a tubular dust collector with section damper for low load operation, a convertible grate damper providing acceptable burning rates at both high and low loads, and overfire air jets and sidewall air jets for the proper mixing of fuel and air. Coal is mechanically distributed over the surface of the stoker grate by feeders equipped with rotor blades. The boiler satisfactorily meets steam load requirements of 50,000 lbs of steam/hr at maxium loads and 5000 lbs at minimum loads and simultaneously reduces stack emissions.

6486 APTIC NUMBER 16299

Schwanecke, P.
ELIMINATION OF NITROGEN OXIDE BY MEANS OF COMBUSTION. (Vernichtung von Stickstoffoxid durch Verbrennen). Text in German. Wasser, Luft Betrieb, 12(6):372-3, June 1968. 3 refs.

The elimination of NO and NO2 by scrubbing with water or sodium lye and their elimination by thermal decomposition are briefly contrasted. The former method has the disadvantage of just removing the NO2 according to the equation 3NO2 + H2O yields 2HNO3 + NO. Thermal decomposition of NO and NO2 between 150 and 620 C in a reducing flame maintained with a lack of air follows the equations 2NO + 2CO yields 2N2 + 2CO2 and 2NO2 + 4CO yields N2 + 4CO2. The oxides are also reliably destroyed at 20% and more excess air. A third method for eliminating NO and NO2 is discussed in greater detail. It is a combined process of absorption of NO2 and combustion of NO. The waste gases of a chemical oxidation process are first passed countercurrent to a scrubbing liquid through a scrubbing tower, where the NO2 is converted to nitric acid. The NO which escapes from the scrubbing tower is mixed with the threefold amount of air and burned in an oil-fired muffle furnace. The furnace consists of two concentric, sheet steel shells. In the space between the two shells cooling air is circulated with a speed of 12 m/sec. The nitrogen oxide-containing air is used for atomizing the fuel.

6489 APTIC NUMBER 16550

Seki, Tameyuki
SULFUR RECOVERY PLANT IN OIL REFINERY. (Sekiyu seisei kogyo o chushin to shita io kaishu sochi ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(4):229-234, Oct. 15, 1965.

Problems associated with the presence of sulfur in oil products are offensive odors, decrease of lead susceptibility, corrosion by combustion gas, and air pollution. Of the methods of fuel desulfurization developed by refineries, the most widely adopted method is hydrogenation. Exhaust gases from the process, however, contain high concentrations of hydrogen sulfide whose recovery is required if air pollution is to be prevented. The efficiency of any given method of hydrogen sulfide recovery depends on the quantity to be processed, composition of materials, and construction costs. The most widely used process involves an absorbent with regenerative capabilities. Compounds in this category include alkanol amines, ammonia, hot carbonate, and phosphates. Alkanol amine methods developed in U. S., are based on the absorbents monoethanol amine, diethanol amine, triethanol amine, and methyl diethanol amine. The most widely employed is monoethanol amine. This substance, however, absorbs carbon dioxide too, and in this case other absorbent must be used. The advantages of monoethanol amine are high activity with good absorption, high desulfurization rates, high stability, and ease of regeneration. Its disadvantages are high price, poor selective absorption, loss by irreversible reaction with COS, and corrosion. These problems, however, are solved rather easily. Monoethanol amine can absorb hydrogen sulfide at 100 F; the reaction is reversed at 240 F. The practical sulfur recovery processes are classified into a partial combustion and split stream process. The compositions of exhaust gas from a sulfur recovery plant which the author constructed were as follows: hydrogen sulfide 0.48%, sulfur dioxide 0.48%, carbon dioxide 1.39%, nitrogen 67.16%, and water 30.50%.

6490 APTIC NUMBER 16425

Slack, A. V.
REMOVAL OF SULFUR OXIDES FROM POWER PLANT STACK GASES: OUTLINE OF MAJOR PROBLEMS. Preprint, Metropolitan Engineers Council on Air Resources, New York, N. Y., p. 42-49, Oct. 1967. 2 refs. (Presented at Symposium Metropolitan Engineers Council on Air Resources, New York City, Oct. 1967.)

Various problems of sulfur oxides removal and its impact on process possibilities were reviewed. The discussion was restricted to twelve major removal processes which are being studied in large test units taking gas from a power plant or other sulfur dioxide producing plants: injection of pulverized limestone into boiler; scrubbing exit gas with lime slurry; absorption in alkalized alumina; absorption in manganese dioxide; absorption in metal oxides; absorption in calcium hydroxide; absorption in ammonia solution; continuous adsorption of cooled gas on carbon with intermittent washing; adsorption of gas on carbon in cyclic process with separate washing; adsorption of gas on carbon followed by heating; catalytic oxidation followed by condensation of acid; and catalytic oxidation followed by injection of ammonia. The several unresolved problems in reducing sulfur dioxide emissions from power plants make the status of both removal and recovery methods uncertain. Some of the problems do not have any obvious solution. These include the large tonnage of the product made, both in regard to space for discarding of waste products and the economics of marketing very large quantities of saleable material produced; declining load factor and variable operation of power plants, with adverse effect on operation of a chemical recovery plant; and the growing use of nuclear power for new plants. For some processes, new fossil fuel plants are more amenable to fitting with sulfur dioxide recovery equipment than are the old ones. The main problem with limestone injection is the short retention time in the boiler and also the presence of cooled surfaces in the boiler, on which molten droplets of slag solidify.

One of the main difficulties with lime slurry scrubbing is that the gas is cooled and therefore loses bouyancy which is important in getting pollutants high in the air before they drift earthward. Other problems in the process operation are the presence of undesirable gas constituents in stack gas, corrosion, gas pressure drop, and low product grade in recovery processes. The process operation problems are less difficult in some respects and progress is being made in solving them.

6491 APTIC NUMBER 16281

Smith, B. V., L. P. Cousins, and G. F. Hewitt
TWO-PHASE TWO-COMPONENT CRITICAL FLOW IN A VENTURI. Atomic Energy Research Establishment, Berkshire, England, Chemical Engineering and Process Technology Div. AERE-R 5736, 27p., 1969. 26 refs.

A functional relationship was established between the primary flow variables at, and just upstream of, the point of critical or checking flow for a liquid-gas mixture. The primary variables were pressure, mass flow rate, quality, and geometry of the channel. Experimental and analytical data are reported for air-water flow in a converging annular venturi with critical and near-critical conditions at the throat. Pressure tappings were placed at regular intervals along the straight outer wall of the venturi and, since the profiled inner core could be moved axially, accurate pressure gradients were very steep. Measurements were made of the flow rate, thickness, and temperature of the liquid film flowing on the outer wall of the venturi. For the analytical treatment, the liquid was assumed to be made up of a film floating on the outer wall of the venturi and of droplets entrained in the gas stream. The interrelated expressions which describe the behavior of each phase were numerically integrated from the entrance to the throat of the venturi, with a correction factor introduced for the maximum available flow area established. The value of this factor was determined by a trial procedure which set the point of critical flow for the analysis at the same exit position as that observed in the experimental program. Good agreement was obtained between experimental and theoretical results with qualities from 0.018 to 1.0, and for venturi throat areas differing by a factor of 2. Discussion of critical pressure ratios, fluid velocities, and interface transport processes are included. (Author abstract modified)

6492 APTIC NUMBER 15992

Springer, Karl L.
PROCESS AND APPARATUS FOR THE RECOVERY OF SULPHUR DIOXIDE FROM SULPHITE LIQUORS. (Standard Oil Development Co., Elizabeth, N.J.) U. S. Pat. 2,137,311. 3p., Nov. 22, 1938. (Appl. March 26, 1936, 3 claims).

A method is described for recovering sulfur dioxide in an anhydrous condition from petroleum sulfite liquor. Concentrated sulfuric acid is fed into the top of a packed tower and then to a reaction chamber along with the sulfite liquor. The reaction of the sulfuric acid and the sulfite liquor causes sulfur dioxide to evolve. The sulfur dioxide passes into a liquid reaction mixture in a separate stripping zone. A current of steam is passed through the reaction mixture to strip it free of sulfur dioxide. The mixture of sulfur dioxide and steam is passed through a cooling zone at a temperature suitable for the condensation of the steam. By passing the resulting sulfur dioxide through a packed tower in countercurrent to the initial sulfuric acid, the sulfur dioxide is rendered anhydrous. The method is also applicable to the sulfite cellulose liquor of the paper industry.

6493 APTIC NUMBER 16720

Stairmand, C. J.
REPORT ON THE REMOVAL OF GRIT, DUST, AND FUME FROM EFFLUENT GASES. Chem. Engr. (London), 221:CE257-261, Sept. 1968. 17 refs.

In general the difficulty of arresting particles increases with their fineness: Grit is relatively easy to collect in simple inertial devices while sub-micron fume requires highly sophisticated equipment such as electroprecipitators, bag filters, and high energy wet washers. The performance data and U.K. costs of twenty types of dust collectors are summarized. Statutory or presumptive limits of emissions for a number of process operations in the U.K., Germany, and Switzerland are tabulated. This is a brief discussion of reports made to the Working Party on Air Pollution of the European Federation of Chemical Engineering.

6494 APTIC NUMBER 16372

Staubing, Peter
CAPACITY QUESTIONS OF INDUSTRIAL DUST COLLECTORS. (Kapazitaetsfragen industrieller Entstaubungsanlagen). Text in German. Wasser Luft Betrieb, 12(1):18-21, Jan. 1968. 2 refs.

Capacity is defined as the ratio between the result and the investment. It depends on many factors. Any evaluation must take into account design criteria, such as the collection efficiency, gas quantity to be cleaned, the pressure difference, and the amount of collected dust. Not all dust collectors can be evaluated in the same way. Considerable differences exist between mechanical collectors and electrostatic precipitators. All mechanically operating collectors have in common a relationship existing between the particle size, the viscosity of the carrier gas, and the sinking velocity of the particles, expressed by Stoke's law. This law pertains to particle sizes between 1 and 40 micron. Any evaluation of the performance of filters designed with the aim of attaining highest collection efficiency must take into account the gas speed and the pressure difference, as well as the energy consumption and the dimensions. It is not always feasible to obtain a uniform collection efficiency. In centrifugal separators, for instance, the gas velocities differ at various points; this affects the collection efficiency. In such cases, the collection efficiency cannot be stated for detailed particle sizes; it can be given only in wide ranges. For cloth filters, the pressure difference assumes great importance. In electrostatic precipators, the travelling speed of the dust particles in the electric field is of importance; it determines the collection efficiency, together with the gas speed and the collection surface.

6495 APTIC NUMBER 16107

Stechkina, I. B., A. A. Kirsh, and N. A. Fuks
INVESTIGATIONS OF FIBROUS FILTERS FOR AEROSOLS: CALCULATION OF AEROSOL DEPOSITION IN MODEL FILTERS IN THE REGION OF MAXIMUM PARTICLE BREAKTHROUGH. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 31(1):97-101, Jan. 23, 1968. 9 refs.

Calculating particle capture coefficients in the region of maximum particle breakthrough is a difficult but important part of the theory of fibrous filters for aerosols. Problems arise because particle deposition in the region proceeds by several nonadditive mechanisms: diffusion, inertia, and accretion. A mathematical model, which considers the simultaneous influence of these mechanisms, is presented for calculating the capture coefficients of aerosol particles with small Stokes numbers in a system of parallel cylinders. With particles of finite size, the capture coefficient is due to particle inertia. Formulae are also derived for predicting the total capture coefficient of aerosol particles in a fan-model filter. At filter flow velocities less than 100 cm/sec, the main mechanisms of particle deposition are diffusion and accretion; the part played by inertia is small.

6496 APTIC NUMBER 16588

Stern, S. A.
INDUSTRIAL APPLICATIONS OF MEMBRANE PROCESSES: THE SEPARATION OF GAS MIXTURES. Southern Research Inst., Birmingham, Ala., Proc. Symp. Membrane Processes for Ind., Birmingham, Ala., May 1966, p. 196-211.

Three permeation processes of practical interest are discussed: the recovery of helium from natural gas; the separation of oxygen from air; and the removal of carbon dioxide from breathing atmospheres. The most promising technique for recovering helium through permeation is based on the permeability properties of Teflon FEP, a copolymer of tetrafluoroethylene and hexafluoropropylene. Plant investment required for a three-stage Teflon FEP permeation plant is considered, together with optimum operating conditions necessary for helium recovery. This technique is still not quite competitive with more advances cryogenic processes for large-scale recovery. The use of silicone rubber membranes for the separation of oxygen from air has been suggested, and 0.0001-in. thick membranes may prove useful for hospitals and other small-scale applications. A permeation process for producing oxygen-enriched air on a large scale cannot compete with conventional processes. For controlling carbon dioxide in closed environments, membrane separation processes appear to hold great promise, with the weight of permeation units reasonably close to that of competing removal systems. The best membrane available for this process is silicone rubber.

6497 APTIC NUMBER 15787

Stratford, Reginald K. and William P. Doohan
METHOD OF FREEING OILS FROM SULPHUR DIOXIDE. (Standard Oil Development Co., Elizabeth, N. J.) U. S. Pat. 1,954,959. 2p., April 17, 1934. (Appl. Nov. 29, 1930, 9 claims).

An improved method is described for the purification of cracked mineral oils which have been treated or washed with a reagent containing or yielding sulfur dioxide. The sulfur dioxide causes corrosion of the distillation apparatus. The acid-washed cracked oil is treated with hot caustic, preferably aqueous sodium hydroxide containing homologues of phenol. This results in the complete elimination of sulfur dioxide-forming compounds. When the treated oil is redistilled, the resulting distillate is found to be substantially free of sulfur dioxide. The temperature of treating is about 280-300 F. Cresols, lyes, naphthenic soaps, and combinations of these may also be used to remove sulfur dioxide. The method also applies to the treating of coal tar oils, shale oils, and the like.

6498 APTIC NUMBER 16243

Stratford, Herbert W.
SULFUR TRIOXIDE SULFONATION METHOD. (Stratford Engineering Corp., Kansas City, Mo.) U. S. Pat. 3,056,831. 4p., Oct. 2, 1962. 7 refs. (Appl. April 25, 1958, 5 claims).

Sulfonation of petroleum with sulfur trioxide produces higher yields of sulfonates than sulfonation with oleum, but yields a stiff sludge that causes sulfonic acid losses. The present invention provides a method and apparatus for controlling the volume of sludge formed when contacting petroleum or other sulfonatable organic compounds with sulfur trioxide, minimizing sulfonic acid losses, and producing by-products free of colored impurities. The sulfonatable material is fed to a verticle double impeller contactor at a point where it is uniformly dispersed in a large cyclic stream of sulfonic acid before being reacted with the sulfur trioxide charge. This enables the sulfonic acid produced by the reaction with sulfur trioxide to be used as a supressant to minimize polymerization and the formation of disulfonates and sulfones. Acid from the contactor is fed to a sludge extractor and then to a flash evaporator where it is degasified to lower the amount of inorganic acids present prior to neutralization. The maximum time desirable from the charge stock to neutralization is five min. Thy process produces both water soluble sulfonates with molecular weights below 400 and oil-soluble sulfonates with molecular weights from 400 to 600. The advantages of the method are especially evident in the production of alkyl aromatic sulfonic acids which, when neutralized, form highly effective detergent compounds.

6499 APTIC NUMBER 15863

Summers, Walter Thornton
IMPROVEMENTS IN OR RELATING TO THE REMOVAL OF VOLATILE SULPHUR COMPOUNDS FROM GASES. (Coal Industry (Patents) Ltd., London, England) British Pat. 983,391. 5p., Feb. 17, 1965. (Appl. May 27, 1960, 10 claims).

Methods of and apparatus for the removal of volatile sulfur compounds from coal gas which has passed through a benzole recovery plant are described. Some or all of the gas is passed through a scrubbing plant where the gas is desulfurized. Part of

the desulfurized gas is passed either directly or indirectly, to a stripping plant to which the scrubbing medium enriched with sulfur compounds, is also passed. Here the desulfurized gas acts as a stripping gas which removes sulfur compounds from the scrubbing medium. The stripped scrubbing medium is then recycled to the gas scrubbing plant for reuse. The scrubbing medium can be a petroleum or coal tar oil distilling between 220 and 360 C. The solvent can be adjusted so that desired amounts of carbon disulphide, carbon oxysulfide, lower homologues of thioethers, and methyl mercaptans are absorbed. Unlike conventional steam distillation methods, little heat is required to strip the scrubbing medium; both scrubbing and stripping can be carried out at atmospheric temperatures. Methane, coke-oven gas, produces gas, or blast furnace gas can be used with the desulfurized coal gas as a stripping gas.

6500 APTIC NUMBER 16309

Swift, Peter
DUST CONTROL IN INDUSTRY-6. Steam Heating Eng. (London), 37(457):12-14, 41, Dec. 1969.

The design and function of dust control equipment is reviewed to enable a more perceptive and economical application of control devices. It is shown that plant failures involve one or more of the four principal components of dust control systems: a system of hooding, a system of ducting, equipment to separate dust or product from the airflow, and a fan to induce air movement through the system. By relating self-evident aspects of dissatisfaction to these components, the user will be able to identify the causes of malfunctions. These aspects are as follows: ineffective control at the source of dust generation; progressive dust deposition within the ducting system; inadequate dust collector efficiency; resistance of the collector to airflow; inability of the collector to discharge collected dust when and as required; plant performance not related to continuous capability; unacceptable noise levels; production inconvenience; excessive maintenance costs; and excessive power consumption.

6501 APTIC NUMBER 16447

Tamm, O. M. and E. F. Vasil'eva
MEASURES FOR REDUCING ATMOSPHERIC POLLUTION IN CITIES OF THE ESTONIAN SSR. (Meropriyatiya po snizheniyu zagryazneniya atmosfernogo vozdukha v gorodakh Estonskoy SSR). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities. (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no.2, Kiev, Budivel'nik, 1968, p.39-40.

Air pollution problems in Estonia center around the cities of Tallinn and Kohtla-Jarve. A paper and pulp plant, a sulfuric acid plant, a mineral-enriching installation, and a shale processing combine are cited as major air pollution sources in the Kohtla-Jarve area and some of the measures taken to control these sources are mentioned. Control measures widely instituted in the country include: conversion to gas and liquid fuels, the use of central heating plants, removal from the cities of large pollution sources such as asphalt-concrete plants, and the closing of installations which do not lend themselves to air pollution control (e.g., the stone crushing facility at the Tallinn concrete plant, and the asphalt-concrete plant at Toyl).

6502 APTIC NUMBER 16189

Tamura, Takaaki, Hideo Minato, Toshimasa Ishikawa, and Yoshio Shindo
A METHOD OF SELECTIVE SEPARATION OR CONDENSATION OF A GAS MIXTURE. (Gasujo kongobutsu o sentakutekini bunri matawa noshuku suru hoho). Text in Japanese. (Yawata Iron and Steel Works, Tokyo). Japanese Pat. Sho44-22171. 5p., Sept. 22, 1969. 5 refs. (Appl. Feb. 10, 1965).

A new adsorbent is used to separate or condense gases by the difference in adsorption due to temperature or pressure change. Zeolite molecular screens have been utilized for separating gases with large differences in molecular radii. The molecular scree is not applicable to gases whose molecular radii are similar. The adsorbent of the present invention is made from rocks or minerals with SiO2, Al2O3, and H2O as primary components. The sum of the total amounts of K2O, Na2O, and CaO is within 1-10w/o. The weight ratio of Al2O3 to SiO2 ranges from 0.15-0.24. The adsorbent minerals are further specified by x-ray diffraction. The adsorbent is obtained by dehydrating the rocks or minerals at 350-700 C. The higher temperature used for activation by drying than with the conventional molecular sieve is one of the main features of the present method. The rocks and minerals used in the invention are produced in Tohoku and Chugoku districts of Japan as a white tuff. The primary advantage of the method is that twice as much nitrogen is adsorbed at room temperature than is possible with conventional adsorbents. Carbon monoxide adsorption is also extremely high. Further advantages of the process are its simplicity and low cost.

6503 APTIC NUMBER 16624

Tarat, E. Ya. and S. A. Bogatykh
OPERATION OF A FOAM SCRUBBER AT ELEVATED GAS PRESSURES. (Rabota pennogo apparata pri povyshennykh davleniyakh gaza). Text in Russian. Khim. i Neft. Mashinostr., no. 4:18-20, April 1965. 3 refs.

The operation of a foam scrubber (formed of a 175 mm wide, 110 mm deep rectangular chamber with a 5 mm thick screen with 2 mm diameter holes placed at mid-height, whose free area was equal to 0.12A, where A equals 0.01925 sq m-cross-sectional area of the chamber, used for absorption of CO2 by foaming water from CO2-bearing air) was investigated at various pressure, speeds, and CO2-contents of CO2-bearing air of specific weight and various intensities of flow of water. In addition to the above quantities, measurements were also made of the air and water temperatures, the height of the foam layer forming on top of the screen, the CO2-concentration in water at the water outlet, and the pressure drop across the scrubber. There exists at every pressure both a maximum permissible air speed and, for any

admissible value of the speed, a limiting permissible intensity of flow of water, both of which decrease with increasing pressure. The degree of CO2-saturation of the outlet water was calculated, using the CO2-absorption rate, and the absorption coefficient. It increases with maximum permissible air speed and, slightly, with CO2 content at constant pressure and intensity of flow of water, as well as with pressure at constant air speed, intensity and CO2 content. An evaluation of the process of CO2-absorption by foaming water from CO2-bearing air passed repeatedly through the scrubber at p equals 5 kg/sq cm, using the experimental findings showed that it is less economical than when it operates at the ambient pressure. In fact, the throughput of air is 28% higher and that of water is 1.3 times smaller, the energy expenditure is 4 times higher and the time required to scrub a given volume of air is 1.3 times longer. This result does not preclude the possibility that with a single passage of air through a multi-screen foam scrubber, a higher operating pressure may prove to be superior.

6504 APTIC NUMBER 15852

Thomas, B. E.
OPERATING STRETFORD PURIFICATION PLANT. Gas J., 159(4157): 283-285, March 11, 1964. 3 refs.

The Stretford process, used to purify coke oven gas at a Middlesbrough, England plant, is explained with respect to modifications and improvements in the procedure since the establishment of the process at the plant. Basically, an alkaline solution of the sodium salts of 2,6 and 2,7 anthraquinone disulfonic acids are used with ammonium vanadate, which is complexed with sodium potassium tartrate to prevent its precipitation. Initial absorption of hydrogen sulfide is by alkali in the pH range of 8.5-9.2, resulting in the formation of a hydrosulfide which is subsequently oxidized to sulfur by the vanadate. The vanadate is reduced and then oxidized in the presence of anthraquinone disulfonic acid (A.D.A.). The plant consists of two washers of the double pass multifilm type packed with wooden grids of high surface area, four delay vessels, two oxidizers, a sulfur sludge tank, and a rotary vacuum filter. The purity of the sulfur approaches 96%. Reformed gas was also processed through the Stretford purifiers using Onia-Gegi units.

6505 APTIC NUMBER 16247

Thomas, T. I. and E. L. Clark
MOLECULAR SIEVES REDUCE ECONOMIC, OPERATIONAL PROCESS PROBLEMS. Oil Gas J., 65(12):112-115, March 20, 1967. 14 refs. (Presented at the NGPA Annual Convention., Houston, March 14-15, 1967.)

Because of their strong adsorptive forces for polar molecules, molecular sieves have important applications in the treatment of gas and liquid process streams. Molecular sieves are reliable dehydrators with an ability to dry high-temperature natural gases to low moisture contents. Dry-bed molecular-sieve treating processes satisfy a variety of sulfur-removal requirements, including pipeline sulfur specifications. Where carbon dioxide content exceeds pipeline specifications, the sieves can be effectively combined with liquid absorption processes. Problems of disposing of sulfur-rich regeneration gases are being overcome by processes such as natural-gas desulfurization of the feed to steam-methane reformers in hydrogen and ammonia plants. The regeneration gas is readily consumed by the reforming furnace fuel requirement. Practical processing cycles for removing carbon dioxide from natural gas streams entering a gas plant use part of the dry, CO2-free product to regenerate thy molecular-sieve beds. The advantages of natural gas pretreatment can be extended to propane and ethane streams. Molecular sieves are also competitive with caustic systems in dehydrating and 'sweeteing' liquid propane, butane, and natural gasoline liquids to reduce their sulfur content.

6506 APTIC NUMBER 16551

Tokyo Inst. of Technology (Japan), Kiyoura Lab.
ABATEMENT OF AIR POLLUTION, I -- (4) SULPHUR DICXIDE. (Aryusan haigasu ni yoru kogai bojoho (sono IV) -- Koon endogasu kara no aryusan gasu jokycho no shinpo (1)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(4):279-281, Oct. 15, 1965.

Results of experiments on wet desulfurization techniques for flue gases are presented in this paper, the first of a four-part report. Succeeding papers will cover the design and operation of small scale combustion furnace using granular coal, the operation of a pilot plant using flue gas from combustion furnace, and the feasibility of the process for large-scale industrial applications. Experiments were carried out at 130 and 330 C. The most active absorbents studied were alkalized alumina and ozides of manganese, cobalt, copper, etc. When desulfurizing the flue gas with an efficiency over 90%, 100 grams of absorbent absorbed 23 to 30 gram sulfurous acid gas at 130 C and 19 to 61 grams at 330 C. Absorption by manganese oxides and alkalized alumina is described in detail. Adsorption by activated charcoal and a molecular sieve under a comparatively high temperature was found to have low efficiency, i.e., 100 grams of adsorbent adsorbed only about 8 grams of sulfurous acid gas. Vanadium pentoxide with potassium as promotor was useful for changing sulfur dioxide into sulfuric anhydride. Flue gas containing 0.35% sulfur dioxide was completely desulfurized at 365 C.

6507 APTIC NUMBER 16138

Tokyo Inst. of Technology, Kiyoura Lab.
PREVENTIVE MEASURE OF PUBLIC NUISANCE BY SULFUROUS ACID EXHAUST GAS (PART V). PROGRESS OF SULFUROUS ACID REMOVAL METHOD FROM HIGH TEMPERATURE FLUE GAS (2). (Aryusan haigasu ni yoru kogai bojoho (sono V)- ko-on endo gasu kara no aryusangasu jokyo ho no shinpo (2)). Text in Japanese. Kogai to Taisaku (J. Pollution Control, 1(5):329-341, Dec. 15, 1965. 28 refs.

A practical method exists for eliminating thick sulfurous acid gas from melting furnace gas. However, all methods of eliminating thin sulfurous acid gas (less than 0.5 percent) from a large quantity of fuel gas require an unjustifiably large investment and operating costs. When SO2 is removed by liquid absorption

processes, some remaining sulfurous acid gas is cooled and precipitated near the chimney. In a bench-scale experiment, 0.3 percent sulfurous acid gas was completely eliminated from a quasi-flue gas without cooling the gas by the use of a solid adsorbent. The experimental stage of selecting absorbent, adsorbent, or other solids capable of catalytic oxidation has been completed. Among the adsorbents tested, oxides of manganese, cobalt, copper, and alkalized alumina were most effective. Manganese oxide and alkalized alumina were studied in detail. Even after several cycles of adsorption and regeneration, no decrease in adsorbent activity was observed. Activated charcoal saturated with metal oxides eliminated sulfurous acid gas at 130 C. At higher temperatures, however, oxidation of carbon took place. For the elimination of sulfurous acid gas at comparatively high temperatures, absorption is preferable to adsorption because of high efficiency. Vanadium pentoxide with potassium promotor is extremely useful to convert sulfurous acid gas to sulfuric anhydride at 300 to 400 C. In quasi-flue gas, sulfurous acid gas was completely converted to sulfuric anhydride at 365 C at the space velocity of 1050 per hour. However, technical or economical data must be obtained before deciding whether the elimination of sulfurous acid gas by a high temperature solid is industrially feasible.

6508 APTIC NUMBER 15941

Tow, Philip S.
CONSIDERATIONS OF THE FEASIBILITY OF CONTROL OF OXIDES OF NITROGEN. J. Air Pollution Control Assoc., vol. 7:234-240, Nov. 1957. 28 refs.

A review of existing theories of the role of nitrogen oxides and hydrocarbons in ozone and smog formation is followed by a consideration of the nature and contribution of various sources of nitrogen oxides in Los Angeles County and an evaluation of methods for controlling the oxides. In Los Angeles, nitrogen oxide emissions are primarily the result of nitrogen fixation in combustion processes, according to the equilibirum N2 plus O2 equals 2NO. Variables in combustion processes are temperature, excess air, and in the case of automobiles, engine acceleration rate. Theoretical and experimental data show that there is no ready solution for the control of nitrogen oxides as a general atmospheric contaminant. Much experimental work needs to be done before satisfactory devices are developed. The importance of research on the catalytic decomposition of nitric oxide is stressed. It is also suggested that methods of accelerating vapor phase reactions of NO may have applications for controlling nitrogen oxide emissions from stationary sources. Other possible methods of control discussed are absorption, adsorption, and changes in the design of combustion equipment or its operation or changes in fuel.

6509 APTIC NUMBER 16365

Tuerkoelmez, S.
NEW METHOD OF WASTE GAS CLEANING. ELIMINATION OF ODORS THROUGH EXCHANGE ADSORPTION WITH ARTIFICIAL ION EXCHANGERS. PART II. [illegible]

Geruchbelaestigungen durch Austausch-Adsorption mittels Kunstharzionenaustauschern. Teil II). Text in German. Wasser Luft Betrieb, 9(12):812-816, 1965.

Experiments in the laboratory and in a pilot plant were conducted with waste gases containing nitrogen oxides. Removal by exchange adsorption with artificial resins (such as amberlite IRA-410 and IR-45) using air or nitrogen as the carrier gas showed that the capacity of the resins was lower in the presence of air. For 1 kg nitrogen gas, 27 l amberlite IRA-410 were needed. Tests on the stability of the artificial resins by saturation in 15% nitric acid for 132 days brought positive results. Experiments with various scrubbing liquids such as water, sodium lye, and dimethylsulfoxide showed that the scrubbing process, which is actually an oxidation process, is improved by the presence of sufficient oxygen. Eleven tests with dimethylsulfoxide solution were performed. The waste gas was first cooled to 20 C and then passed over dimethylsulfoxide solution. The solution was regenerated over artificial resins which bound the HNO3 and possibly also the HNO2 through exchange adsorption. The efficiency of this method was between 80 and 98%. For regeneration of the scrubbing liquid, 300 liters of artificial resin per week were needed. The resins in turn had to be regenerated once a week with 10% sodium lye. During the experimental period, the resins suffered no decline in capacity.

6510 APTIC NUMBER 15856

Tyrer, Daniel
IMPROVEMENTS IN OR RELATING TO THE RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES. (Imperial Chemical Industries Ltd., London, England) British Pat. 400,998. 4p., Nov. 6, 1933, (Appl. May 6, 1932, 9 claims).

The invention relates to processes for treating gases with small sulfur dioxide concentrations, e.g., gases derived from sulfide-ore roasting, with solvents from which the sulfur dioxide is expelled by heating and/or reduction in pressure, the solvent being recovered for further use. With most commonly used solvents, only a fraction of the sulfur dioxide is recovered. This amount is materially increased by using a solvent containing a salt of a nonvolatile acid that is stable under working conditions and having at least one dissociation constant of the same order as the first dissociation constant of sulfuric acid. Suitable acids are lactic acid, glycolic acid, or citric acid. The metallic radical employed can be an alkali or alkaline earth metal, or ammonium. Since the amount of sulfur dioxide that can be absorbed is proportional to the amount of salt dissolved or held in suspension, the efficiency of the process is improved by using a solution of two or more salts, e.g., NaH2PO4 plus NH4H2PO4. The use of a nonvolatile acid with a dissociation constant between 0.1 and 0.00001 insures that the double decomposition occuring during absorption and sulfuric acid generation proceeds far enough in the direction of sulfite or bisulfite and free acid to promote increased sulfur dioxide absorption.

6511 APTIC NUMBER 16346

Uno, T., S. Fukui, M. Atsukawa, M. Higashi, E. Yamada, and K. Kasei
SO2 CONVERSION-6. SCALE-UP OF A SO2 CONTROL PROCESS. Chem. Eng. Progr., 66(1):61-65, Jan. 1970. Parts 1-5. Ibid, Aug. p. 62; Sept. p. 69; Oct. p. 74; Nov. p. 73; and Dec. p. 61, 1969.

At a semi-commercial power plant, which treats 150,000 cu Nm hr pf flue gas, up to 90% sulfur dioxide removal is effected by a process which uses activated manganese oxide as the absorbent. Ammonium sulfate is recovered as a by-product through regeneration of the spent absorbent. In the process, the powdery absorbent is fed to the absorber where it is dispersed in the flue gas, transported with the gas stream, and reacted with the sulfur oxides. The resultant manganese sulfate and the excess of unreacted absorbent are collected in a mechanical separator and electrostatic precipitator. The greater part of the collected absorbent is returned to the absorber as recycled solids and the remainder regenerated and recycled. Absorption takes place at 100-180 C while the absorbent is transported with the flue gas. A recycle-to-refreshed solids ratio of 6:1 or 7:1 is used, depending on the sulfur oxides concentration of the flue gas. The amount of absorbent escaping with flue gas is less than 10 mg/cu Nm and its manganese content, less than 15%. The high collection efficiency of the plant is due in large part to absorbent properties such as large particle size, high specific density, and optimum electric resistivity. The absorber scale-up is described in detail and equations given for over-all reaction rates. The scale-up shows that the effect of gas velocity and absorbent concentration are negligible in commercial absorbers, which can be designed on the basis of the calculated value of mean residence time at given conditions.

6512 APTIC NUMBER 16408

Urban, Guenter
DUST COLLECTION SYSTEMS AND THEIR USE IN INDUSTRY.
(Entstaubungssysteme und ihr Einsatz in det Industrie). Text in German. Wasser Luft Betrieb, 12(2):61-67, Feb. 1968.

Centrifugal separators, packed columns, cloth filters, venturi scrubbers, orifice scrubbers, and the electrostatic precipitator are described. The collection efficiency of cyclones depends on their diameter. The smaller the diameter, the better the efficiency. At an optimum pressure loss of 60 to 80 mm water, collection efficiencies of 50 to 90% can be reached. Packed towers have a somewhat higher pressure loss (100-150 mm water). Particles of less than 0.5 micron are separated in cloth filters or electrostatic precipitators. With bag filters, the dust content in the waste gas can be reduced to below 50 to 100 mg/standard cu m. Wet collectors require low investment costs while the operating costs run high. Electrostatic precipitators are the most widely used dust collectors. Their efficiency is high, with a power consumption between 0.2 to 0.4 kWh/1000 cu m gas. The particular use of each collector in the metallurgical industry is discussed and schematic illustrations of gas cleaning systems are given. For sintering and pelleting plants, electrostatic precipitators, cloth filters, and wet collectors can be used. In coking plants, wet electrostatic precipitators are used.

6513 APTIC NUMBER 15777

Urban, Peter and Lester G. Massey
PRODUCTION OF SULFUR. (Universal Oil Products Co., Des Plains, Ill.) U. S. Pat. 3,023,088. 5p., Feb. 27, 1962. 3 refs. (Appl. July 5, 1960, 6 claims).

In many industrial processes, large amounts of sulfur are wasted by being vented to the atmosphere as hydrogen sulfide, in addition to creating an abatement problem. Typical of these are processes for preparing various petroleum products, coking of coal, steel manufacture, and others. In many cases, the sulfur is converted to hydrogen sulfide during processing and disposed of in that form. A process was invented for recovering sulfur dioxide from hydrogen sulfide in the form of elemental sulfur. It also provides a method for purifying a gas stream by removing hydrogen sulfide. Sulfur dioxide and hydrogen sulfide are absorbed by a carboxamide solvent with radical groups selected from hydrogen and alkyl radicals containing 1-4 carbon atoms and having 0.5 - 40% water dissolved in it. The sulfur dioxide and hydrogen sulfide react with the solvent to form water and sulfur, which can be separated from the solvent. The preferred carboxamides are diethylformamide, dimethylacetamide, and dimethylpropionamide.

6514 APTIC NUMBER 16563

Valtsev, V. N., B. N. Basargin, and V. A. Kolobikhin
RECOVERY OF HYDROGEN IODIDE FROM THE GAS STREAM IN THE VENTURISCRUBBER IN THE OXIDATIVE DEHYDROGENATION OF HYDROCARBONS. (Ulavlivaniye iodistogo vodoroda iz gazovogo potoka v skrubbere Venturi pri okislitel'nom degydtirovanii uglevodorodov). Text in Russian. Khim. Prom. (Moscow), no. 11:26-28, 1969. 16 refs.

The absorption of HI from gaseous mixtures by 0.5 N water solutions of Na2CO3 and NaOH was studied in the Venturi scrubber, with the central supply of sorbent going through the nozzle having a propeller-like insertion. A detailed description of the apparatus is given. The use of propeller elements at the exit of the liquid from the nozzle enables a rapid increase in coefficient of injection, a decrease in sorbent consumption per volume unit of treated gas, and a decrease in the resistance of the apparatus. The resistance of the scrubber increased with increasing gas velocity and it was negative for gas velocities higher than 22 m/sec. The degree of HI absorption decreased with the increasing gas velocity in the nozzle. The highest absorption coefficient (97.7%) was observed at a gas velocity of 10.5 m/sec, a temperature of 10 deg, and an initial HI concentration equal to 5.9%. The volume coefficients of mass transfer were determined. The highest values were obtained for low HI concentrations in the mixture and for increased gas velocity. The variation of temperature between 40-70 deg did not have considerable effect on HI absorption in water solution of Na2CO3. Similar results were obtained with 0.5 N NaOH as a sorbent. The venturi scrubber with a propeller element for dispersion of the liquid phase was thus observed to guarantee high degree of recovery of HI and high coefficient of mass transfer.

6515 APTIC NUMBER 16444

Varshavskiy, I. L. and R. V. Gargala
PROTECTION OF CITY AIR FROM MOTOR VEHICLE EXHAUST GASES. (Zashchita vozdukha gorodov ot vykhlopnykh gazov avtotransporta). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities. (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p.56-61.

Carbon monoxide and hydrocarbon levels in areas of heavy traffic in Moscow exceed permissible levels by as much as tenfold, even though these conditions are far better than in U. S. or West European cities. Studies made in the USSR have shown that the CO emission per km of travel of a motor vehicle depends on the travel speed, road quality, and fuel system, but has little connection with the amount of carbon monoxide given off during idling. Some 50 stations for dynamic testing of individual cars for harmful emissions have been set up in Moscow. These stations make about 600,000 tests per year. Various means of improving combustion and eliminating crankcase fumes are reviewed. The use of electric cars, especially those utilizing direct conversion of chemical energy of a fuel to electrical energy, is seen as the ultimate answer to this problem. Research in this area is being carried out in the USSR.

6516 APTIC NUMBER 15997

Viard, Marcel Jean
MEANS AND TECHNIQUE OF WORKING WITH SULFUR DIOXIDE. (Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey, Paris, France) U. S. Pat. 2,676,872. 2p., April 27, 1954. 4 refs. (Appl. Jan. 2, 1951, 7 claims).

An invention is described which improves the handling, storage, purification, and concentration of sulfur dioxide. The invention also provides for a superior sulfur dioxide mixture usable as a reaction medium, or capable of discharging its content of sulfur dioxide immediately without any substantial accompanying losses. A mixture of glycol sulfite and sulfur dioxide is formed at ice-bath temperature. This composition can be maintained at low temperature for as long as desired. To obtain sulfur dioxide in a purified and concentrated gaseous condition, the mixture is moderately heated. During the heating, all but a very little sulfur dioxide will be expelled leaving other absorbed gases behind in the glycol sulfite.

6517 APTIC NUMBER 16446

Vypov, A. I. and G. N. Makarets
PROTECTION OF THE AIR AND WATER BASINS AT NOVOKUZNETSK. (Zashchita vozdushnogo i vodnogo basseynov v novokuznetske). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities. (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p.37-38.

An overall examination of the pollution problems of Novokuznetsk was made in 1965-1966 by the Deputy Commission on Natural Conservation and the Presidium of the Novokuznetsk Branch of the Association for Natural Conservation. Dust emission from the Kuznetsk cement plant was 260 tons per day in 1962; it was reduced to 50 tons per day by the end of 1966, and the installation of electrofilters at two roasting furnaces in 1968 reduced emission to 10 tons per day. Measures were also taken to reduce emission from the aluminum and iron-smelting plants. Efforts at pollution control in this city are regarded as successful and similar measures are recommended for other Soviet cities.

6518 APTIC NUMBER 16334

EXHAUST SYSTEMS AND DUST REMOVAL EQUIPMENT IN THE WOOD WORKING INDUSTRY. (Absaugeanlagen und Entstaubungseinrichtungen in der holzverarbeitenden Industrie). Text in German. Wasser Luft Betrieb, 13(7):256-258, 1969.

Individual exhaust systems, group exhaust systems, and central exhaust systems were shown in connection with wood working machines at the fair in Hannover. Individual exhaust fans are primarily used in small plants; they require a relatively large space and are expensive. Central exhaust systems are usually installed in large plants; their disadvantage is that they must be adapted to any plant modification. For dust removal, cyclones and bag filters for small plants were on display. Cotton was selected as material for the bag filters. These filters are cleaned manually. The saw dust falls into plastic bags or waste containers. Various wet filters and round bag filters with an automatic shaking device were also on display. Because of the great fire hazard, the air and sawdust mixture discharged by the collectors is best directly incinerated without intermediate storage. For smaller plants a press for wood chaff was shown which reduces the volume; the compressed material can be stored.

6519 APTIC NUMBER 15998

Williams, Milton
REMOVAL OF H2S FROM GASES. (Standard Oil Development Co., Elizabeth, N. J.) U. S. Pat. 2,403,319. 3p., July 2, 1946. (Appl. June 20, 1942, 4 claims).

A method of removing H2S and other acidic components from gas mixtures is reported. The gas is scrubbed with a liquid mixture containing a combination of a basic material and a phenol which increases the acidity of the mixture. A solid adsorbent which has a preferential adsorbitivity for acidic substances is added to the mixture. The preferred adsorbent is a charcoal activated by a heat treatment in the presence of air. The adsorbent substantially increases the absorption capacity of the absorbent.

6520 APTIC NUMBER 15839

Yanagisawa, S. and M. Isomura
MANUFACTURE OF SULFUR DIOXIDE GAS. (Aryusan gasu no seizo-ho).

Text in Japanese. (Hodogaya Chem. Ind. Co., Tokyo) Japanese Pat. Sho 34-2960. 2p., April 24, 1959. (Appl. Feb 15, 1957 claims not given).

The waste acidic substances derived from the purification system of crude petroleum refineries includes a great many sulfur compounds and can be utilized to manufacture sulfur dioxide gas by the following two procedures. First, the waste substance is added to a calcium sulfite (CaSO3) solution causing formation of SO2 gas as well as H2S, mercaptans, and organic sulfur compounds. The CaSO3 used in this procedure is obtained at low cost by the absorption of SO2 waste gas from other refineries by alkaline calcium compounds also derived from other industries. The plaster produced by the first procedure is utilized for the manufacture of cement or nickel sat. Secondly, a mixed gas including several kinds of volatile sulfur compounds is heated within the hearth at 600 C to form SO2 gas. This is a convenient and economical means of producing SO2 from the waste substances of the petroleum refinery.

6521 APTIC NUMBER 16289

Yeselev, I. M., I. P. Mukhlenov, and D. G. Traber
CERTAIN QUESTIONS ABOUT THE OPERATING REGIME OF A COMBINED CONTACT-TOWER SYSTEM. (Nekotoryye voprosy rezhima raboty kombinirovannoy kontaktno-bashennoy sistemy). Text in Russian. Zh. Prikl. Khim., vol. 37:1204-1210, May-Aug., 1964. 13 refs.

Analysis of data from the literatures showed that optimum temperatures in the preliminary catalytic oxidizing arrangement with a fluidized catalyst bed are subject to the same dependences as in arrangements with a stationary bed. Formulated calculations indicate that a system producing 315,000 tons of sulfuric acid per year is economically feasible with a preliminary oxidation arrangement using an iron oxide catalyst with a particle size ranging from 0.80 to 1.30 mm.

6522 APTIC NUMBER 16290

Yeseleve, I. M., I. P. Mukhlenov, and D. G. Traber
USE OF IRON CATALYST IN THE CONTACT-TOWER PROCESS. II. (K voprosu ispol'zovaniya zheleznogo katalizatora v kontaktno-bashennom protsesse). Text in Russian. Zh. Prikl. Khim., vol. 37:972-979, May-Aug., 1964. 14 refs.

The rate of sulfur dioxide oxidation in a reactor with a fluidized iron oxide catalyst bed is reduced as compared with a reactor with a stationary layer. The degree of reduction in rate is characterized by the ratio of contact time required to achieve a given degree of conversion in a fluidized catalyst bed to the analogous contact time for a stationary layer, all other conditions being equal. Empirical formulas derived for determining this ratio are shown to describe the kinetics of SO2 oxidation in an arrangement with a fluidized catalyst bed with sufficient accuracy. Verification on a pilot installation has demonstrated complete suitability of these equations for designing industrial reactors.

6523 APTIC NUMBER 16203

Yushkevich, N. P. an/ V. A. Karzhavin
PRODUCTION OF SULFUR FROM SULFUR DIOXIDE. IV. PILOT-PLANT EXPERIMENTS AT THE TSARITSYNSKII EXPERIMENTAL FACTORY. (Poluchenie sery iz sernistogo gaza. IV. Polyzavodskie opyty poluchenie sery iz sernistogo gaza, proizvedennye na Tsaritsynskom opytnom zavode). Text in Russian. Khim. Prom. (Moscow), 8(11-12):1053-1058, 1931.

Two different types of charcoal-burning furnaces were employed in an experimental apparatus for the reduction of sulfur dioxide. Gas containing 12-13% sulfur dioxide and 8-9% oxygen was passed at a temperature of about 100 deg into a reaction chamber in which a temperature of about 700-800 deg was maintained; this was sufficient to complete the reaction. If the sulfur dioxide content of the gas was greater than 13%, the gas as it entered the chamber had to have a temperature higher than 100 deg. A uniform content of sulfur dioxide was required to keep the process properly regulated and also a constant supply of charcoal was necessary. The apparatus had to be sheathed in iron to prevent leakage of gas. In order to obtain pure sulfur, it was necessary to remove charcoal dust by passing it through an intermediate precipitator at a temperature of 300-400 deg.

6524 APTIC NUMBER 16464

Zalogin, N. and N. Nechaeva
OXIDATION OF SULFUR DIOXIDE IN A HIGH FREQUENCY DISCHARGE. (Okisleniye sernistogo angidrida v vysokochastotnom razryade). Text in Russian. Zh. Fiz. Khim. vol. 4:832-844, 1933.

Laboratory investigations were carried out with a view to developing a pilot plant and then a commercial method for the oxidation of sulfur dioxide by high frequency discharge. The effect of the following factors on the amount and rate of oxidation of sulfur dioxide were studied: 1) concentration of sulfur dioxide in the gas, 2) the length of time the gas remained in the discharge, 3) moisture of the gas, 4) temperature of the gas, 5) concentration of oxygen in the gas. In addition, the oxidation of sulfur dioxide by ozone in alkaline solution was studied. It is shown that the yield of sulfur dioxide oxidized decreases with increase in the percentage of sulfur dioxide in the gas from 0.5-2.5%. The optimum time for oxidation in the discharge was 20 sec. Neither the amount of moisture in the gas nor the temperature of the gas had much effect on the yield.

6525 APTIC NUMBER 16162

Zhovtyuk, G. V., I. N. Keitelgisser, Z. Sh. Berinberg, G. S. Pigorov, P. Ya. Kuleshov, A. G. Belichenko, E. I. Voitenko, and A. Ya. Bortnik
EQUIPMENT FOR THE WET SCREENING OF COALS. Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), vol. 3:10-12, 1969. 3 refs.

A unit for the wet screening of run-of-mine coals (WSU) with a screen working area of 4 sq m was designed and built. Tests were

conducted to compare the results obtained by dry screening on vibration screens and wet screening on the WSU, to determine the performance of the wet screening process, and to assess the relative merits of the two processes. Results indicated that much poorer separation was achieved by type VGD-2 and VGO-2 vibration screens than by wet screens. This was largely caused by the tendency of the mesh openings in vibration screens to become clogged up with moist coal fines. The specific throughput of the wet screen was also much greater. The criteria used to evaluate the practical performance of the WSU were the loss of coal in the tailings and the relative contents of concentrate fractions from the coarse and fine fraction jigs. Wet screening is efficient enough to improve the plant performance figures, even with increased throughputs and higher ash figures on the run-of-mine coal. The reduction in the moisture content of the coarse concentrate was explained by the increased efficiency of wet screening, which reduces the amount of undersize material remaining on the screen. The design of the screen is simple; it includes no moving parts, is lighter in construction, and occupies less floor space. The wet screen is less expensive to operate and maintain. Working conditions were improved by the reduction of air pollution and the absence of harmful vibration. The elimination of frequent stoppages during autumn and winter in order to remove the wet coal from the vibration screens reduced average time losses by 70 minutes per shift. Better performances were obtained from all the equipment in the plant, and the weight of run-of-mine coal cleaned during the first quarter of 1968 was increased by 30 thousand tons.

6526 APTIC NUMBER 16587

Adlon, G. L.
FLUORESCENT PARTICLE GENERATION AND DETECTION SYSTEM FOR VALIDATION OF STERILITY MAINTENANCE. Inst. Environ. Sciences, Inst. Environ Sci. Annu. Tech. Meet. 14th, St. Louis, Mo., 1968, p. 35-41, 4 refs. (April 29-May 1).

Three electronic fluorescent particle detectors were designed, developed, and evaluated for applicability in a sealed, sterile environment. Two of the designs were based on dynamic sampling of a relatively low-velocity air stream containing the particles. The particles passed through a light-tight chamber where a mercury arc light source and a filtered photomultiplier detector, connected to an integrating counter, monitored the stream for fluorescein particles. An interference filter with a band-pass characteristic (0.55 micron center) provided discrimination between dye and dust particles which fluoresce at different wavelengths. The technique was not sufficiently sensitive to low particle concentrations. The detection technique ultimately adapted is defined as an integrating or particle accumulating detector. The dye particles, if airborne, are drawn through a vacuum intake port, accelerated to a velocity of approximately 450 ft/sec during passage through a constriction, and impacted on a glass slide. A tungsten 0.6 w light source causes the dye particles to fluoresce in the green, and optical filtering restricts the reradiated energy to an emission band centered at 0.0533 micron. A simple optic system transfers the target area radiation to a solid-state photodiode, and a chopper minimizes the low-frequency noise of the detector. Integration of this concept with terminal heat sterilization cycles is feasible and offers a simple means for sterility monitoring in many applications without the disadvantages of microbiological methods.

6527 APTIC NUMBER 16171

Armstrong, David H.
PORTABLE SAMPLER FOR MICROORGANISMS IN INCINERATOR STACK EMISSIONS. Appl. Microbiol., 19(1):204-205, Jan. 1970. 1 ref.

To obtain reliable information on viable microbial cells in incinerator stack emissions, a new sampling device was developed that will concentrate microorganisms from large quantities of stack emissions into a small quantity of 0.067 M phosphate buffer. The simple, portable sampler provides a method for qualitative, nonisokinetic sampling, adjustable to isokinetic conditions that will yield quantitative results. The sampler is mounted on a steel plate and can be enclosed by a metal cover with a handle attached. One side of the base is a vacuum pump and on the other side of the base, a 700-ml, wide mouth, Pyrex bottle containing 300 ml of the phosphate buffer. The two-hole rubber stopper has a piece of cotton-plugged glass tubing in one of the two holes. The sampling probe is made of stainless steel tubing. The probe end has a right-angle bend so that the opening faces the stack gas current. The tubing is coiled to permit additional cooling of the gases and is straight for 1 or 2 ft at a right angle to the other straight length. Before use, the sampling probe is sterilized. When sampling, the probe is inserted into the stack at locations that will yield a representative sample. The other end of the probe is inserted through the sterile rubber stopper to approximately 0.5 inches above the buffered solution to prevent too much frothing. The vacuum pump is activated to draw the air sample through the tube. The microorganisms are then impinged into the phosphate buffer. After sampling, the buffered water is examined in the laboratory like any other aqueous microbiological sample. The flow of gases through the sampler can be regulated in various ways: by the diameter of the tubing itself, by a limiting orifice or valve, or by adjusting the rate of flow pulled by the vacuum pump. The flow rate can be determined by a flowmeter mounted upstream from the vacuum pump under the various conditions of temperature and pressure encountered in sampling. This sampler was devised to cope with the hot gases from stack emissions.

6528 APTIC NUMBER 16134

Atsumi, Michisato, Hiroshi Kiyozumi, Kazuko Ito, Teruyuki Sudo, and Tsunako Oshima
AN INVESTIGATION OF AIR POLLUTION BY ODOR---ESPECIALLY THE COMPARISON OF THE AIR POLLUTION IN AND OUT OF PLANTS. (Akushu ni yoru taiki osen chosa---toku ni kojo naigai ni okeru hikaku kenkyu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(7):407-410, July 15, 1967. 5 refs.

Comparative measurements of indoor and outdoor air pollution are reported for two petroleum plants in Yokkaichi city. Instantaneous concentration measurement methods were used: the instant an odor became offensive air was collected and analyzed by gas chromatography. The two plants were comparatively isolated from other plants. Inside one plant, numerous ground-level pollutants of high density were detected. On the leeward side of the plant a variety of substances was also present, but in smaller concentrations. Few pollutants were detected on the windward side. Certain substances were detected at a point one km to the west of the plant; less odorous substances were in most cases detectable 100 meters away. Under certain conditions the reverse occurred. The data obtained by gas chromatographic analyses are tabulated.

6529 APTIC NUMBER 16701

Bell, J. H., Sue Ireland, and A. W. Spears
IDENTIFICATION OF AROMATIC KETONES IN CIGARETTE SMOKE CONDENSATE. Anal. Chem., 41(2):310-313, Feb. 1969. 12 refs.

Because of the complexity of cigarette smoke, extensive fractionation was necessary to isolate and identify minor components. The separation techniques involved solvent partition, column, paper, and gas chromatography. The gas chromatographic system allowed the collection of smoke constituents for subsequent analysis by ultraviolet and infrared spectroscopy and mass spectrometry. From the study of one subfraction which represents 0.08% of the original weight of the condensate, fluoren-9-one, the four methylfluoren-9-ones and seven other alkylated fluoren-9-ones were identified. (Author's Abstract)

6530 APTIC NUMBER 16157

Bergmann-Lehnert, Ilse
METHOD FOR DETECTING DUST DEPOSITIONS ON LEAVE SURFACES. (Methoden zum Nachweis der Verschmutzungen von Blattoberflaechen). Text in German. Wiss. Z. Tech. Univ. Dresden, 11(3):571-574, 1962. 7 refs.

Dust emissions from industrial plants affect vegetation in various ways: the incident light may be attenuated; the soil may be changed chemically; the leaves may be injured by deposition of toxic dust; and plant assimilation may be weakened by crusts of indifferent dusts on the leaf surface. In the latter case, objective determination of the degree of dust settlement on the leaves is necessary. An exact replica of the leaf surface is used without dislocating the dust particles. A simple method proved to be very efficient for field tests. Adhesive tape is applied to the leaf or leaf section and pressed on with the finger to avoid any air bubbles. A folder with a larger number of loose leaves of oleate paper is recommended for collecting the leaves. They dry out less rapidly if stored this way, which is important for the removal of the tape. For the microscopic study, another adhesive tape of the same width is applied to the replica, which can be placed into glycerine gelatine, Canada balsam, and glycerine chloral hydrate. For isolation of the dust particles for a physical or chemical analysis, the tape is put into benzene or xylole. The light attenuation by the dust from a cement kiln on an ivy leaf was measured; it reached more than 50%.

6531 APTIC NUMBER 16211

Bernert, Juergen and Reiner Engsfeld
EXPERIENCES WITH A MODIFIED METHOD FOR DETERMINATION OF THE TOTAL AMOUNT OF COMBUSTIBLE ORGANIC SUBSTANCES IN WASTE GASES. (Erfahrungen mit einer modifizierten Methode zur Bestimmung der Gesamtmenge verbrennbarer organischer Substanzen in Abgasen). Text in German. Wasser, Luft Betrieb, 12(7):422-425, July 1968. 6 refs.

A plant manufacturing glass fiber insulating panels, a brake lining manufacturing plant, a wire manufacturing plant, and two chicken manure drying stations are discussed with respect to how they determine organic substances in waste gas. In the first three plants, vapors from solvents and phenols and their cracking products were analyzed. In the first case, 3 silica gel probes were used since it was not known how the method would respond to mineral oils. However, hydrocarbons could be detected at all measurements. With larger volumes drawn through the probes within an equal period of time, a higher loading of probe 2 was observed. This may be explained by the fact that of the water vapor/oil mixture, the former shows greater affinity to the silica gel than the latter, which impairs the oil mist adsorption. The result of 30 measurements in the second plant showed that the carbon concentration in the uncleaned gas experienced a maximum at each temperature increase which subsided until the next temperature increase. The carbon concentration of the cleaned gas is almost independent of time, which indicates that the afterburning system has an efficiency of more than 90%. Generally it can be said for all measurements in all three types of plants that no major difficulties were encountered. Quantitative adsorption was achieved in almost all cases in the first section of the first silica gel probe. The result of measurements in the chicken manure drying plants showed that the initially present mercaptans appeared in none of the analyses, which indicates that they are oxidized to sulfates. It was further found that these gases contain further organic emission components which can presently not yet be identified (presumably fatty acids and their derivatives).

6532 APTIC NUMBER 16230

Breuer, Wolfram
THE INFORMATION SUPPLIED BY CONTINUOUS IMMISSION MEASUREMENTS. (Die Aussagekraft kontinuierlicher Immissionsmessungen). Inst. Ind. Water Econ. Air Pollution Forum, vol. 3, 12p., 1965. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 26p.

Effective measures against air pollution require an extensive knowledge of the type, origin, distribution, and effect of air pollution. Many complex interactions are uncovered by emission measurements and their evaluation. The potential of modern measuring techniques are discussed and illustrated by examples from the air monitoring program of the Farbenfabriken Bayer AG, where more than 20 automatic emission measuring units for various gas components have been erected. Characteristic parameters of emission concentrations are obtained by plotting cumulative frequency curve over a logarithmic abscissa. A 50% value of the cumulative frequency curve indicates the most probable emission to be expected for recovery periods after the occurrence of peak concentrations. The peak concentrations are characterized by the 95% value of the cumulative frequency. The numerous data supplied by automatic monitoring units is rapidly digested by this statistical method. The data obtained permits a classification according to certain criteria, such as the influence of wind velocity or direction, weather conditions, the time of day or season, etc. Half-hour emission values are correlated with wind direction data to provide information on the origin of emissions. Further valuable information on emission sources is derived from direct evaluations of simultaneous measurements of several gas components. These parallel measurements help to distinguish emissions from combustion processes in the open air from other emissions and provide information on the fuel used in the particular instance.

6533 APTIC NUMBER 15945

Bukatyy, V. I. and S. S. Khmelevtsov
CORONA DEVICE FOR CONTINUOUS MEASUREMENT OF CLOUD AND FOG MICROSTRUCTURE BY THE METHOD OF SMALL ANGLES. (Oreol'naya ustanovka dlya nepreryvnogo izmereniya mikrostruktury oblakov i tumanov metodom malykh uglov). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii Fiz., no. 1:91-94, 1968. 15 refs.

An optical device and method for monitoring cloud and fog microstructure by the method of small angles is described. Results from measurement of the microstructure of artificial fog are presented. Measurements were in good agreement with those gotten by direct sampling. These preliminary results indicate that the method may be used successfully to study the kinetic distribution function in rapid interaction processes.

6534 APTIC NUMBER 16111

Burk, Marvin C. and Lewis E. Roof
ACOUSTICAL APPARATUS FOR DETECTING THE COMPOSITION OF A GAS. (Phillips Petroleum Co., Bartletsville, Okla.) U. S. Pat. 3,468,157. 4 p., Sept. 23, 1969. 3 refs. (Appl. March 3, 1966, 5 claims).

Known acoustical techniques for detecting changes in the composition of gases issuing from a gas chromatograph involve passing a gas mixture through one acoustic resonator and the same mixture less one of its components through another. The frequencies produced by the resonators are compared and their differences used as an indication of the gas composition. Because frequencies of the signals are low, acoustical changes are usually too low to be significant. These shortcomings are overcome by the present invention which uses high frequency signals and an electrical signal that detects a small change or delay in signal frequency. The magnitude of the change or delay of the signal is representative of the gas composition. The apparatus includes an acoustical chamber with a pair of spaced traducers, an oscillator for passing the signal to one of the traducers, and a variable frequency oscillator for establishing a second signal. The output of the first oscillator is mixed with that of the variable frequency oscillator that is adjusted by a phase angle detector between the mixed signals. The detector is connected to a delay line by an electric lead and the latter to an indicating recorder. The low frequency transmitted by the electric lead is representative of the small changes in the high frequency signal resulting from a change in the gas composition in the acoustical chamber.

6535 APTIC NUMBER 16516

Burough, I. G.
ATMOSPHERIC OZONE MEASUREMENTS. (FINAL REPORT). Dalmo Victor Co., Belmont, Calif., Contract PH 86-68-55, 50p., Dec. 12, 1967. 1 ref.
CFSTI: PB 187392

Long path infrared absorption measurements of atmospheric ozone concentrations in Los Angeles were performed using an ozone sensor. The sensor measures ozone concentrations as a function of time. It consists of a transmitter and a receiver which are separated by a line-of-sight path of 800 feet to 1600 feet. Since the ozone sensor measures ozone in terms of its optical absorption, it was necessary to provide a concentration, path length, and calibration factor. The calibration was accomplished by the introduction into the optical path of a test cell of accurately known length. The test cell is filled with ozone generated by passing oxygen through a high voltage electric discharge apparatus. The quantity of ozone was determined chemically. The concentration of ozone in the test cell is increased by the ratio of the nominal operational path length to the test cell length. Data were collected in the downtown Los Angeles area and from three other ozone sensors. The correlation between the infrared ozone sensor and the other instruments was calculated. The correlation coefficient between the infrared ozone sensor and the three other systems was consistently the lowest tabulated. The lower correlation was the result of two factors: the infrared sensor is specific to ozone as opposed to total oxidants, and qualitative tests indicated that the infrared sensor in insensitive to atmospheric quantities of SO2 or NO2; the infrared sensor provides an average value by measuring over a long sample path, as opposed to the other three instruments which are point samplers. Ozone sensor data were given.

6536 APTIC NUMBER 16714

PARTICLE COUNTING TECHNOLOGY. Contam. Control, 8(1):11-14, 16-25, Jan. 1969.

The state of the art in particle counting is discussed. Particle monitoring, counting, and identification are an essential part of nearly every contamination control program. The diversity of the available methods, and the lack of agreement on their validity and use, are a direct reflection of the diversity of opinions on safe contamination control practices. A number of instruments which have applications in this field are described. A directory of particle counting instrument manufacturers is also included.

6537 APTIC NUMBER 16278

Cooper, R. E.
WRED, A SITING CODE TO ESTIMATE DOSE PROBABILITY DISTRIBUTION FROM MEASURED METEOROLOGY DATA. Preprint, Health Physics Soc., 8p., May 15, 1968. 3 refs. (Presented at the Health Physics Society, Annual Meeting, Denver, Colo., June 16-20, 1968.)

Potential off-site doses of radioactive materials were determined from a reactor by measuring the frequency of occurrence of various simultaneously occurring atmospheric dispersion conditions and calculating the resulting potential off-site dose following an assumed radioactivity release. A 1200 ft tower was instrumented to obtain measurements of temperature, wind speed, and wind direction. Data were obtained at 3 min intervals for two years. To minimize the time required for computer processing of the data, a code was developed that utilized measured data to determine dispersion properties; perform whole body gamma and thyroid inhalation doses; classify each dose according to magnitude, distance, and release height; and provide output suitable for dose vs frequency of occurrence analyses. The major output provided by the code is the number of times the dose estimate falls within each dose increment, the percentage of the total cases this number represents, and the cumulative percent of all cases up to and including this increment. From this information, the dose vs frequency of occurrence is determined as a function of distance.

6538

APTIC NUMBER 16123

Crump, N. L. and T. T. Bartels
TOXIC GAS CONTAMINANTS IN ENCLOSED ENVIRONMENTS. Contamination Control: Current and Advanced Concepts in Instrumentation and Automation, 9(1):20-25, Jan. 1970. 2 refs.

Techniques were developed for collecting samples of toxic gases from enclosed atmospheres and quantitatively determining the concentration of these contaminants by analytical instrumentation. A gas sampling flask was developed which was conveniently used in the laboratory where danger of breakage during testing is at a minimum. However, since some test programs required sampling at remote areas or under conditions that increased the probability of breakage, a larger, more durable container was required. A sampling unit was described which was portable, capable of withstanding shock, capable of containing the sample for extended periods of time, and durable enough to be shipped to and from remote test sites. The design of the sampling unit permitted either manual collection of a sample in each flask by opening and closing the needle valve by hand, or automatic collection through a solenoid-valve control. Three sets of sample of aircraft cabin air were collected. The samples were analyzed chromatographically for carbon monoxide and carbon dioxide; colorimetrically, for the oxides of nitrogen; and polarographically, for lead. More sensitive detection capabilities were required for the gas chromatography than usually obtained. Improved detection limits for carbon dioxide and carbon monoxide were attained by modifying the gas chromatographic instrumentation. The most important change was in the detection system. When a thermistor detector was used, detection limits were improved from 90 ppm CO2 and 150 ppm CO to 14 ppm CO2 and 12 ppm CO. The effect of temperature on the thermistor was also determined. The sensitivity at 30 C was many times greater than that at 250 C.

6539

APTIC NUMBER 15745

Dubois, L., R. S. Thomas, T. Teichman, and J. I. Monkman
A GENERAL METHOD OF ANALYSIS FOR HIGH VOLUME AIR SAMPLES. I. SULFATE AND SULFURIC ACID. Microchim. Acta, vol. 6:1268-1275, Nov. 1969. 11 refs.

A method for analyzing high volume samples, particularly with respect to sulfates and sulfuric acid, was described which makes use of microdiffusion at 200 C to separate the volatile sulfate fraction from an aliquot portion of an air sample on a glass fiber. This separation ensures that only fixed sulfate is left in the aliquot disc after heating, and that the sulfuric acid, if originally present, will be removed. At the same time, any sulfuric acid evolved is trapped in a sodium hydroxide absorbent, which can be analyzed for fixed soluble sulfate using a method specifically for sulfates. The measurement of the separated volatile sulfate may then be carried out by microtitration or by square wave polarography. The polarographic method is more rapid and agrees with values found by microtitration; it is readily adapted to large scale analyses, and analytical speed can be improved. The proposed method is free from inaccuracies and ambiguities associated with procedures which depend upon pH measurement or non-specific acid-base titration.

6540

APTIC NUMBER 16259

Eguchi, Tadashi and Shinzo Tanaka
INSTRUMENTATION OF A CONTINUOUS SULFUR DIOXIDE ANALYZER BASED ON STARCH-IODINE COLORIMETRY. (Yoso denpun bishokuho ni yoru bisanka io nodo renzoku sokutei sochi no shisaku). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 17(4):417-422, April 1968. 6 refs.

The spectrophotometric measurement of the change of absorbance of a starch-iodine solution was described for the continuous determination of sulfur dioxide concentrations in the atmosphere. The reagent which passes through a reference cell is sent to a measuring cell after reductive decolorization from sulfur dioxide in an absorption column. The difference in the absorbance of the two cells at a wavelength of 600 millimicron is continuously read using a CdS photoconductive cell. Pollutants which interefere with the determination of sulfur dioxide are chlorine, hydrogen sulfide, and ozone. Carbon dioxide, ammonia, hydrocarbons, and carbon monoxide do not interfere. Experimental results from Osaka, Kyoto, and Yo aichi indicated that concentrations of sulfur dioxide in the suburbs were generally below 0.01 ppm. The sulfur dioxide concentrations were 0.2-0.45 ppm in the vicinity of street crossings and showed an almost linear response to traffic. (Author abstract modified)

6541

APTIC NUMBER 16409

Einbrodt, H. J., H. Beploh, and M. Leenders
LIGHT AND ELECTRON MICROSCOPIC DETERMINATION OF THE GRAIN SIZES OF AIRBORNE DUSTS OVER LARGE CITIES. (Licht-und elektronenmikroskopische Korngroessenbestimmungen von Schwebestaeuben aus Grossstaedten). Text in German. Arch. Hyg. Bakteriol. (Munich), 150(1/2):100-106, 1966. 10 refs.

Airborne dust over a large residential area and an industrial city was sampled with an electrostatic precipitator. A total of 30 samples were obtained. They were transferred to the microscopes either in a dry state (15 samples) or flushed from the collection plates with distilled water, dried at 105 C and transferred. The dust samples were then photographed by means of an electron and a light microscope and subsequently counted. The mean values of all measured dust samples were plotted as a relative sum curve. They ranged from 0.02 micron to 10.0 micron with the 50% value at about 0.07 micron. The 15 samples obtained over the industrial city (dry transfer) yielded 50% values of 1.16 to 2.00 micron in the light microscopic range and 0.058 to 0.083 micron in the electron microscopic range. In the wet prepared samples, the 50% values ranged from 1.13 to 1.70 micron (light microscope), and from 0.066 to 0.075 micron (electron microscope). All dust samples taken in the residential area were transferred in wet state from the collection plate. The 50% values ranged from 0.058 to 0.070 micron (electron microscope) and from 1.25 to 1.90 micron (light microscope). In the wet transferred samples, smaller and less coarse particles were counted. The dust samples collected in the residential area showed a slightly wider spectrum of grain sizes, i.e., in the electron microscopic range, smaller particles

were found and in the light microscopic range, larger particles were found.

6542 APTIC NUMBER 15815

Parreng, Robert, Colette Rossetti, Francoise Bourbonneux, and Pierre Parchewitz
MOLECULAR SPECTROSCOPY WITH A LASER SOURCE. STUDY OF THE CO2 BAND AT 1064 RECIPROCAL/CM. (Spectroscopie moleculaire avec source laser. Etude de la bande de CO2 at 1064/cm). Text in French. July 18, 1966. 5 refs. C. R. Acad. Sci., Paris, Ser. B, vol. 263:241-243

Measured values of the absorption coefficient at the center of some spectral lines of vibrational-rotational transitions in CO2 (centered about 1064 reciprocal cm and obtained by using the laser emission of CO2) were used to determine the moments of the vibrational-rotational transition and the collision half-width for each of these lines. Results of these measurements and computations were compiled in a table. The possibility exists of using the values of the absorption coefficient at the center of a spectral line in conjunction with measurements of the partial pressures of the gases in a mixture (whose laser emission includes that line) to determine the effect of a small perturbation on the collision half-width of that line. Thus, the theoretical relationship can be derived between the ratio z is identical to Q(A-B)/Q(A-A), of the effective cross section of collisions of molecules of species A and B and that of collisions of molecules of species A among themselves; the ratio p(B)/p(A) of the respective partial pressures; and the above mentioned absorption coefficient. Measurements were carried out on the P(20) line of the band centered about 961 inverse cm of the laser emission of a CO2-N2 mixture at two partial pressures of CO2 and at several values of the p(N2)/p(CO2) ratio between 0 and 1.5. The data lay very close to the straight line of slope z; yet the value of Q(CO2-N2) determined in this manner differed appreciably from those found by other methods.

6543 APTIC NUMBER 16013

Field, S., M. M. Trieff, A. K. Mukherji, and K. Gabriel
ANALYSIS OF FUNCTIONAL GROUPS OF TRACE VOLATILES BY GAS PHASE COLLECTION AND SYRINGE TECHNIQUE. Preprint, Drexel Inst. of Technology, Philadelphia, Pa., Environmental Engineering and Science Program and Drexel Inst. of Technology, Philadelphia, Pa., Dept. of Chemistry, 5p., 1969 (?).

A method to determine the nature of the functional groups in components of industrial odorous emissions, such as rendering plant emissions was discussed. Vapor concentration was necessary because attempts at chromatographing ambient air were unsuccessful. A freeze-out method was employed, using a test tube and rubber stopper as the sampling vessel. Laboratory tests showed this to be an effective freeze-out medium giving approximately 25% recovery with known groups. Glass beads of various sizes and glass wool were tried as packings, in addition to using the empty vessel. The glass beads gave slightly better recoveries at the expense of a smaller volume of vapor. The results of sample runs at a rendering plant showed this system to be fairly effective in obtaining a concentrated vapor sample. The analysis itself was based on the method of Hoff and Feit. However, it was not possible to repeat the results. No reduction of dimethyl amine could be secured by use of dilute HCl. A saturated KMnO4 solution failed to give any appreciable reduction of heptaldehyde. Concentrated H2SO4 failed to cause any noticeable reduction of heptanone or heptaldehyde. Samples taken at the rendering plant were treated with all of the above mentioned analytical reagents, with no noticeable change in the chromatographs of the treated and untreated samples. In view of the inability to get positive tests for knowns, this result is not meaningful. It was concluded that the lack of success may be due to the fact that the concentration of sample in the sample vessel is below that of 10 to the minus 8th to 0.00001 g/ml level required for this type of reaction to take place. Perhaps either heating of the reaction syringe or using higher concentrations of reagents would help speed up the reaction.

6544 APTIC NUMBER 16367

Fitzek J. and H. J. Einbrodt
THE CHEMICAL ANALYSIS OF AIRBORNE DUST. (Die chemische Analyse von Luftstaubproben). Text in German. Arch. Hyg. Bakteriol. (Munich), 149(5/6):394-400, 1965. 11 refs.

The quantitative microchemical analyses of silicon, aluminum, iron, calcium, sulfur, and lead in airborne dust sampled over large cities are described. The dust samples were transferred into a platinum vessel either in a dry state (in which case a brush was used) or they were flushed off the sampler with deionized water. In the latter case, evaporation and a two-hour drying process at 120 C followed; the former case, drying alone sufficed. Part of the dried dust was used for the SiO2 analysis. The remainder was decarbonized at 400 C and subsequently treated in the Simon-Mueller oven for 4 hours at 700 C. After ashing, the SiO2 was evaporated with 2 ml hydrofluoric acid and 8 N HCl was added. Of this suspension, 10 ml were evaporated in a quartz bowel for Pb analysis. The remaining 15 ml was passed through an infrared analyzer where iron, aluminum and calcium were separated. The substance was collected in a 400 ml quartz glass after rinsing with 80 ml 8 N HCl and evaporated. The residue was washed with 0.5 ml 4 N PCl and replenished to 25 ml in a graduated flask. The iron was washed out from the exchange with 0.1 N HCl replenished to 100 ml, and directly analyzed. From the 25 ml flask aliquote, parts were taken for the calcium and aluminum analyses. A step by step description for each of the analyses is given. The method is suitable for concentrations of 2 mg.

6545 APTIC NUMBER 15707

Flux, J. H., D. J. Smithson, and H. N. Smithson
SIMPLIFIED DUST SAMPLING APPARATUS FOR USE IN IRON-AND STEELWORKS. J. Iron Steel Inst., 206(12):1188-1193, Dec. 1968. 7 refs.

The development of simple but reliable apparatus for dust loading, particle size, and particle shape determination is described.

Although designed to meet the specialized requirements of iron- and steelworks, the equipment and techniques could well find application in other industries. (Author's Abstract)

6546 APTIC NUMBER 16620

Freedman, R. W. and H. W. Lang
A COMPARISON OF INFRARED AND GAS CHROMATOGRAPHIC METHODS FOR DETERMINATION OF METHANE IN MINE AIR. Bureau of Mines, Washington, D. C., RI-7179, 4p., Sept. 1968.
CFSTI: PB 182672

The gas chromatographic method was compared with the infrared method used for confirmatory determination of methane in mine air. In terms of speed, convenience, and precision, the gas chromatographic method was far superior to the infrared method. The comparable infrared analysis required almost a full day per sample; the gas chromatographic analysis could be performed in 10 min, including sample injection and calculation. Replicate analyses were unnecessary. Only one or two standards had to be run per day because of the lack of drift and the high degree of precision. A coefficient of variation of less than 1% was attainable. Separation of methane from other hydrocarbons was complete with the use of molecular sieve columns under proper experimental conditions. This provided the specificity for methane that is essential. The amount of sample required for the chromatograph was only 10 ml compared with 100 ml or more for the infrared cell. The need for such a small quantity indicated the possibility of taking mine-air samples in syringes. This would save space, weight, time of sampling, and time of injection into the instrument, and would avoid the use of mercury for gas transfer. (Author conclusions modified)

6547 APTIC NUMBER 14586

Girard, L. and A. C. Harkness
METHOD FOR ANALYZING THE EFFLUENT FROM A MICROREACTOR.
J. Gas Chromatog., 5(10):516-517, Oct. 1967. 5 refs.

The microreactor or pulse technique is well suited to catalyst evaluation studies. A slug of reactant in a stream of carrier gas is passed over the catalyst contained in a small reaction zone. The effluent is led to a chromatographic column where the components are separated and detected. In a study of the catalytic oxidation of organic sulfur compounds, two conditions prevented the direct application of the pulse technique. A component would be retarded by absorption in the microreactor, and air as a carrier is not compatible with thermal conductivity detectors. A modification was made so that this technique could be applied to detecting sulfur compounds. The effluent gases were passed over a collecting column to absorb the components. These were desorbed into a stream of helium which carried them to the chromatographic system. Since SO2 production was the main interest of the study, silica gel, which has been used to collect SO2, was chosen as the adsorbent for the collecting column.

6548 APTIC NUMBER 16085

Golesworthy, R. C. and D. E. P. Ripp
A CONCICAL PROBE FOR SAMPLING IONS FROM HIGH TEMPERATURE GASES. Rocket Propulsion Establishment, Westcott, England, TM-486, 7p., Dec. 1968. 2 refs.
CFSTI: AD692057

A method is given for producing a stainless steel conical sampling probe shell with an orifice of about 0.1 mm made in a platinum insert at the cone apex. The probe preserves the composition of highly reactive gases during sampling of ions, free radicals, or atoms. The cone was used to sample flames with linear velocities of about 30 meter/sec at 1300 to 2000 C and atmospheric pressures. The maximum sampling rate permitted by pump throughput was about 0.6 std atm cu cm/sec. Estimated distortion of the flow field velocites during sampling was no more than five percent at a distance of one orifice diameter upstream of the probe. As formed by spark erosion, the internal surface of the sampling hole is rough. When in contact with flame gases under sampling flow conditions, the surface acquires a smooth finish and long-term dimensional stability. If mounted in a heatsink, no damage to the cone occurs during four hours of contact with flame gases at 2000 C. If the flange is connected to a water-cooled face-plate, the cone will operate at temperatures below 950 C. The normal lifetime of a cone is 60-100 hours of use, after which contamination or enlargement of the orifice renders it unserviceable.

6549 APTIC NUMBER 16476

Grossman, Ye. M., A. V. Gudimenko, and Ye. A. Penchev
FIELD INSTRUMENT FOR DETERMINATION OF THE OPTICAL DENSITY OF AEROSOLS. (Poligonnyy pribor dlya opredeleniya opticheskoy plotnosti aerosoley). Text in Russian. Meteorol. Klimatol. i Gidrol., no. 3:61-64, 1968. 3 refs.

A photoelectric direct-reading or automatic tape-recording field instrument is described. It is powered by a 12-volt storage battery and incorporates a photo-resistor forming one leg of an unbalanced dc bridge, a dc to dc inverter with type P4 transistors, a magneto-electric microammeter, and an electronic potentiometer, developed for continuous measurements of the optical density of different portions of smoke screens or clouds of aerosols. Its sensing head is formed by an electro-optical receiver and a light source illuminating it, both mounted 1 to 1.5 meters apart on a horizontal bar supported on a tripod whose height above the ground can be varied between 1.5 and 3.5 meters. It is rendered insensitive to light from sources other than its own by incorporating in the receiver an objective lens with three successive diaphragms with coaxial circular apertures of progressively smaller diameters which is mounted on the bar in such a manner that the optical axis of the lens passes through the light source formed by a small electric light bulb and a reflector producing a thin pencil beam directed towards the receiver. Thus, light from any off-axis source whose image is necessarily off-axis in the focal plane of the lens is intercepted by the third diaphragm,

while light from the own on-axis source imaged onto the small aperture in the focal plane is admitted to the photoresistor.

6550 APTIC NUMBER 16449

Hartogensis, F.
DETERMINATION OF THE DUST CONTENT IN THE ATMOSPHERE. (De bepaling van het gehalte aan stof in de atmosfeer). Text in Dutch. Chem. Weekblad, 61(14):161-164, April 2, 1965. 21 refs.

The determination of atmospheric dust is considered with special reference to two widely-used methods: the Thermal Precipitator and the Herhlet apparatus. For measuring the weight of the dust, a filter method is usually employed which measures the gravimetric dust content in mg dust/cu m air. Dust is defined and the difficulty of fixing upper and lower limits of dust concentration is discussed. Numerical dust content is determined by the lower limit and the gravimetric content, by the upper limit. For some situations, none of the methods described may be applicable, and it is improbable that a simple method for dust content determination can be found for general use. These difficulties makes the comparison of different measurement results impossible. A large number of measurements at a few measuring stations is preferable to a few measurements at a large number of stations. It is difficult to correlate the values obtained by numerical and gravimetric dust content measurements.

6551 APTIC NUMBER 16335

Helbig, Herbert
USE OF AMPEROMETRY AND RELATED METHODS OF ELECTROCHEMICAL ANALYSIS IN OPERATING MEASURING TECHNIQUES. (Die Amperometrie und mit ihr verwandte elektrochemische Analysenmethoden in der Betriebsmesstechnik). Text in German. Chem. Tech. (Berlin), 21(9):553-557, Sept. 1969. 53 refs.

After reviewing the theoretical principle of amperometry, the determination of substances such as oxygen, chromate, nitric oxide, and sulfur dioxide by this method is discussed. Two metallic electrodes submerged in the solution to be analyzed are used. It is important that the reaction at the electrode is so rapid that only the substance transported from the solution to the phase boundary determines the reaction speed. The electric current at the electrode is then directly proportional to the concentration of the substance to be measured. For measuring nitric oxide, amperometry has the disadvantage that at concentrations of more than 2%, the substance transport is so rapid that the current density no longer depends on the concentration. In this case, it is better to use chronocoulometry. Potential is applied in jumps to the electrode instead of the stationary current and the current flowing within a certain time interval after the jump is integrated. For measuring SO2 in waste gases, waste gas enters a solution of 0.5 m sulfuric acid and 0.05 m potassium bromide at constant speed. Current enters the solution via two platinum electrodes. Bromine develops at the anode and is reduced by the SO2. The redox potential of the solution is measured with a third platinum electrode and a reference electrode. Minimum concentrations of 0.1 to 1 ppm and maximum concentrations of 1 to 10 ppm can be measured.

6552 APTIC NUMBER 15977

Heszina, A. J.
QUANTITATIVE DETERMINATION OF CARCINOGENIC HYDROCARBONS THROUGH FLUORESCENT SPECTROPHOTOMETRY. (Carcinogen szenhidrogenek mennyisegi meghatarozasa fluorescens szinkepelemzessel). Text in Hungarian. Egezsegtudomany, 11(2):131-135, 1967. 4 refs.

The aromatic hydrocarbon content of air samples amounts to 1-100 ppm of the solutions prepared for spectrophotometric analysis. If the solutions are not purified by chromatography, the results of the spectrophotometry will be rather uncertain. The method reported here combines chromatographic purification of the solution at room temperature with spectrophotometry at -196 C. Liquid nitrogen is used for cooling because of this low temperature the spectrograph shows very sharp lines. The low temperature measurement is very fast and provides advance information on whether time-consuming deep-cooling is warranted. The chromatographic purification process uses an aluminum trioxide column.

6553 APTIC NUMBER 16616

Hiam, Leon and Saul Chaikin
DEVELOPMENT OF A SIMPLE AUTO EXHAUST ANALYZER. (FINAL REPORT.) Stanford Research Inst., Menlo Park, Calif., Contract PH 86-66-60, SRI Proj. PHU-5859, 18p., Aug. 1966. 23 refs.

The feasibility of applying a heated filament combustible gas detector for separately analyzing the total hydrocarbons and carbon monoxide in auto exhaust gases was determined. The first phase was a detailed study of the filament temperatures required for oxidation of selected hydrocarbons and CO on a platinum filament. Additional work was conducted on the effect of O2 and hydrocarbon concentration on the oxidation initiation temperature; the interacting effects in simple gas mixtures were studied. The data showed that the required analyses could not be made on the basis of the platinum filament temperature. Rhodium, iridium, palladium, palladium-silver, and palladium-gold alloys, oxidized nickel, gold, and oxidized cobalt were tested in a search for materials which might show greater selectivity in catalyzing oxidation of hydrocarbons and CO. None of these materials were found to make the required analyses feasible on the basis of filament operating temperature. Two procedures were evaluated for making a preliminary separation before analysis with a heated filament. Hopcalite catalyst was used to remove the CO from the gas sample by selective oxidation. Problems associated with the adsorption of hydrocarbons on Hopcalite made the procedure of doubtful use. Silica gel was used to selectively remove hydrocarbons from the gas sample so that an analysis for CO could be made on the heated filament. The complications it introduced were such that the basic simplicity of the combustible gas detector was lost. Since the separate analyses for hydrocarbons and carbon monoxide did not seem feasible, an effort was made to construct a detector that would measure total combustibles minus hydrogen and the lower aliphatic hydrocarbons. The procedure utilized a platinum wire 'preburner' whose function was to selectively combust hydrogen. This procedure did not succeed because carbon monoxide was found to inhibit the selective

combustion of hydrogen over platinum at low temperatures. It was concluded that the combustible gas detector does not show any great potential for auto exhaust analysis. (Author summary modified)

6554 APTIC NUMBER 16277

Hill, D. W. and H. A. Newell
THE VARIATION WITH POLARIZING VOLTAGE OF THE RESPONSE TO METHANE, CARBON DIOXIDE AND NITROUS OXIDE, OF A MACRO-ARGON IONIZATION DETECTOR FOR GAS CHROMATOGRAPHY. J. Chromatog., vol. 32:737-739, 1968. 15 refs.

Response curves with unexpected characteristics were obtained for methane, carbon dioxide, and nitrous oxide during an investigation of the physical processes governing the operation of a macro-argon ionization detector. A previously recorded response vs polarizing voltage for an argon detector to various concentrations of propane is contrasted with the obtained response vs polarizing voltage of an argon detector to various concentrations of methane. The former is the commonly recorded response to organic vapors with ionization potentials less than the energy of the argon metastable atom. The methane curve illustrates a reversal of sign with voltage increase. This variation could explain previous, contradictory observations at unquoted field strengths. At low applied voltages, the positive responses for methane, carbon dioxide, and nitrous oxide are reported to have similar form, with carbon dioxide having nearly twice the response of methane and nitrous oxide. The negative response observed at the high voltage region was approximately identical for all three vapors. At 30 V, when the response of each gas was at a maximum, the response of carbon dioxide coincided with that of propane. The results are in contrast to predictions that responses to methane, carbon dioxide, and nitrous oxide would not occur, since the ionization potentials of the substances are higher than the argon metastable level. It is suggested that the positive responses are due to lower recombination coefficients resulting from a lowering of primary electron temperature by inelastic collisions with added gas molecules.

6555 APTIC NUMBER 15802

Hollis, O. L.
SEPARATION OF GASEOUS MIXTURES USING POROUS POLYAROMATIC POLYMER BEADS. Anal. Chem. (U. S.), 38(2):309-316, Feb. 1966. 5 refs. (Presented at Advances in Gas Chromatography, Third International Symposium, Houston, Texas, Oct. 1965.)

Outstanding separations of volatile compounds were achieved with columns of polyaromatic polymer beads synthesized by suspension with a diluent to give a highly porous structure. Notable sharp, symmetrical peaks, and low retention volumes were found for water, alcohols, and glycols. These polymer packings have partition properties of a highly extended liquid surface without the problems of support polarity, liquid-phase volatility, or freezing point which hamper gas-liquid chromatography. The porous polymers can be synthesized from monomers such as styrene, tertiary-butylstyrene, and ethylvinylbenzene with divinylbenzene as crosslinker. Applications of porous gel polymer columns range from the analysis of oxides of nitrogen to the determination of diethylene glycol in dipropylene glycol. The analysis of trace quantities of water in a variety of materials is greatly facilitated because water is eluted very rapidly with good peak shape from the columns. The columns are also useful where the adsorptive properties of the stationary phase contributes to tailing or skewing of the peak from materials such as carbon dioxide and acetylene on gas-solid chromatographic systems and water on most gas-liquid chromatographic systems. (Author abstract modified)

6556 APTIC NUMBER 16012

Ingram, William T.
SMOKE CURVE CALIBRATION. New York Univ., N. Y., School of Engineering and Science, Contract PH-86-68-66, 74p., March 1969. 6 refs.

The shape of a smoke curve was established for fine suspended particulates in New York City comparable to the International Smoke Curve. The two commonly used reporting units of surface concentration, microgram/cu m and Coh/1000 lineal feet, were related to each other. A smoke curve for New York City was developed at two locations: one representing a heavily populated area with industrial, commercial, and vehicular influence on particle emissions; the other representing urban residential living. The relationship between curves for these sites and between curves derived for New York and the International Smoke Curve was basically the same between 0 and 45 darkness index. It was further shown that the New York City curve can be normalized to 30 microgram/sq cm at a darkness index of 25. This positioning compares with 17 microgram/sq c, (England) and 20 microgram/sq cm (International Smoke Curve). A graphical presentation is shown that will permit the conversion of either U. S. or European data by entering with a measured darkness index and reading the equivalent concentration in microgram/cu m. A standard curve is also provided for New York City whereby entry can be made in Coh/1000 ft and read as microgram/cu m, thus providing an easy and direct reading that can be used in comparison of particulate density concentrations measured in the European system. The possible relationships between particle count differentiated by size range and particulate density in terms of light transmittance and/or light reflectance was investigated. The concentration is greatest and most significant when the Coh/1000 ft value is related to total particle count in the size range 1.0-2.0 micron. The relationship appears to be most stable for ambient air relative humidities between 31 and 47%. It was believed that with relatively small error, the New York City curve could be used for making relative comparisons of small size suspended particulates in the atmosphere based on Coh/1000 ft readings as they are routinely taken. The procedures offered a calibration curve index for other locations which can be established quickly for curve positioning. However, more work is still needed.

6557 APTIC NUMBER 16022

Ireland, F. E.
AIR POLLUTION IN TEHRAN: COMMISSIONING OF AIR MONITORING APPARATUS AND ADVICE ON DEVELOPMENT OF AN AIR POLLUTION CONTROL PROGRAMME 18 OCTOBER - 6 NOVEMBER 1966. World Health Organization, Geneva, Switzerland, Regional Office for the Eastern Mediterranean, Assignment Report, EM/ES/94, Iran 45/Regular, 15p., Jan. 1967.

This report deals with the purchase of equipment for monitoring concentrations of smoke and sulfur dioxide, total oxidants, carbon monoxide, and nitrogen oxides in Tehran. It is hoped that evidence of pollution obtained by daily monitoring will convince health authorities of the need to establish air pollution control programs. Industrial sources of pollution in Tehran are represented by plastic works, brickworks, and cement factories. Recommendations are presented for controlling emissions from these sources. Data on power plants and their fuel consumption and general fuel consumption are tabulated. While the total mass emission is not high at present at Tehran, it may increase with increasing industrialization unless natural gas becomes available. Factors affecting dispersion are the heights of chimneys, plume rise due to buoyancy, and the hindering of dispersion by stable layers of air in the atmosphere. It is recommended that the production of smoke should not exceed Ringelman 2 and that industrial pollution sources be provided with electricity for mechanical combustion equipment. A control laboratory must be set up to analyze samples collected by the monitoring equipment, and epidemiolcgical research at Tehran University should be linked to air pollution monitoring program.

6558 APTIC NUMBER 15873

Jackson, Peter John and James William Laxton
IMPROVEMENTS IN OR RELATING TO THE MEASUREMENT OF GAS CONCENTRATION IN GAS MIXTURES. (Central Electricity Generating Board, London, England) British Pat. 1,030,541. 8p., May 25, 1966. (Appl. Jan. 2, 1964, 13 claims).

A method for measuring gas concentrations in gas mixtures has particular application to the measurement of concentrations of sulfur trioxide in fuel gases from oil-fired burners. The method involves passing a sample of the gas at a known rate into an extractor, removing the particular gas in solution, passing the solution through a reactor bed containing a reagent giving a colorimetric response to the gas, and periodically filling an optical cell with the colored solution. The color density of the solution is determined photoelectrically. Sulfur trioxide is conveniently removed from fuel gas or a solution in aqueous isopropyl alcohol. The suggested reagent contains barium chloranilate. Sulfur dioxide may be determined by passing it through an iodine solution which oxidizes SO2 to SO3.

6559 APTIC NUMBER 16288

Jacobs, G. E. and L. B. Snowman
LASER TECHNIQUES FOR AIR POLLUTION MEASUREMENT. IEEE (Inst. Elec. Electron. Engrs.) J. Quantum Electron., 3(11):603-605, Nov. 1967. 2 refs.

Performance of a very long air-path spectrometer for use in air pollution measurements can be greatly enhanced using IR lasers. The CO2 isotope laser offers the potential of high power and narrow emission lines, thus providing longer range and higher resolution. By using a mixture of several isotopes of CO2, the gaps between branches can be filled and the wavelength range increased. This requires a sealed-off laser. Work is described with a grating and mirror inside the laser without Brewster windows, using a six-foot cavity. A number of advantages are achieved if a longer effective length, folded into a shorter more portable configuration, is used. Eventual application appears promising for an absorption spectrometer used to monitor the air over large areas. The step-tuneable laser source and corresponding detector system could be mounted on a roof top or other high point in some convenient central location and aimed at a corner reflector mounted on a helicopter. Tracking can be manual or automatic. By modulating the laser source, even the range of the helicopter could be recorded automatically. As the remote reflector is carried past critical areas, the changes in absorption spectra could be used to both identify and locate pollution sources.

6560 APTIC NUMBER 16306

Johnson, M. C.
NITRIC OXIDE MEASUREMENTS IN THE FAR ULTRAVIOLET. Bendix Tech. J., 2(3):90-93, Autumn 1969. 3 refs.

Future control of air pollution from motor vehicles will require the accurate detection and control of nitric oxide emissions. The techniques most commonly used for nitrogen oxide determinations are based on infrared absorption, visible absorption, and wet chemical reactions. Infrared determinations are hampered by water vapor and carbon dioxide interference. Visible absorption and chemical reactions take too much time. The feasibility of a nitric oxide detector based on absorption at 2262 A (ultraviolet) was studied. Interferences, absorption measurements at candidate wavelengths, and sensitivities were determined. This was accomplished by passing various gases and gas mixtures through an absorption cell of known length and measuring the decrease in intensity of monochromatic light passing through the cell. Absorption measurements in the ultraviolet had the advantage of using simple, low-noise, solar-blind detectors in contrast to visible and infrared detectors which are noisier even when cooled. Pre-treatment is far simpler, since the inorganic gases and lighter hydrocarbons, which are difficult to remove, do not interfere in the ultraviolet. The system is relatively simple and can probably be fabricated to be both rugged and inexpensive. Though other techniques, particularly those based on emission characteristics, may ultimately be utilized in more sensitive, more compact, or more rapid instruments, their potential is not yet demonstrated. If the advantages of the ultraviolet detector are exploited, it should be possible to design a detector with operating characteristics as good as those of the best instruments available.

6561 APTIC NUMBER 16238

Kelley, Myron T.
CURRENT CAPABILITIES IN ANALYSIS OF TRACE SUBSTANCES: ELECTROANALYTICAL METHODS. Missouri Univ., Columbia, Proc., Missouri Univ. First Annual Conference on Trace Substances in Environmental Health, Columbia, Mo., 1967, p. 46-50. (July).

The capabilities of electroanalytical methods of trace analysis are reviewed. The methods include electrolytic conductivity, glass electrodes, specific ion electrodes, voltammetry, and coulometry; each of which is readily adaptable to automated and continuous measurements. Electrolytic conductivity is widely used to monitor total salt concentration of water and occasionally used in continuous measurements of sulfur dioxide concentrations. Glass electrodes, formerly used primarily in hydrogen determinations, are now responsive to ions other than hydrogen. Other specific ion electrodes are crystal membranes, electrodes using organic membranes, or electrodes with a silicon rubber matrix. Trace elements down to 10 to the minus 9th power can be analyzed by voltammetric techniques using mercury electrodes. Voltammetry is especially useful for electro-reducible or oxidizable ions. A specialized application of voltammetry and one important in environmental analysis is analysis for dissolved oxygen. Coulometry, though not an ordinary trace analysis technique, has applications for monitoring substances in flowing liquid or gas streams. Coulometric techniques are recommended for analyses of mercaptans or sulfides in gaseous streams and toxic atmospheric amines.

6562 APTIC NUMBER 16056

Keneny, Stal and E. C. Halliday
METHODS RECOMMENDED FOR THE MEASUREMENT OF AIR POLLUTION IN SOUTH AFRICA. Council for Scientific and Industrial Research, Pretoria, South Africa, National Physical Research Lab., CSIR-PIS 10, 12 p., 1968. 3 refs.

A standard method, suited to South African conditions, for measuring atmospheric sulfur dioxide concentrations is described. The method is based on the reaction between sulfur dioxide and hydrogen peroxide. The principle of the hydrogen peroxide method consists of drawing a measured volume of air through a gas-washing bottle containing a dilute solution of hydrogen peroxide. The resultant increase in acidity of the solution is determined by titration using a pH meter, and the sulfur dioxide concentration in the air is calculated from the amount of titrant used. The method is not specific because it also measures gaseous acidity; it is affected negatively by ammonia and positively by acid or acid-forming compounds present in the air. Normally the concentrations of these interfering substances are much smaller than those of sulfur dioxide and can be ignored. The measurement of sulfur dioxide can be combined with the measurement of smoke and suspended matter primarily by drawing the air stream through a filter paper. The apparatus used for sampling is inexpensive and simple to use. Despite its nonspecificity, the hydrogen peroxide method is the simplest and most suitable for measuring sulfur dioxide and is recommended for the continuous measurements.

6563 APTIC NUMBER 16361

Kessler, R. I.
QUALITY CONTROL ASPECTS OF CHRYSLER'S CLEANER AIR SYSTEM. Preprint, American Society for Quality Control, Milwaukee, Wis., 11p., 1968. (Presented at the Conference American Society of Quality Control, 22nd Annual Technical, Philadelphia, Pa., 1968.) (Also: Automotive Industries, 141(7):74-97, Oct. 1, 1969.)

The quality control procedures of Chrysler's program to comply with Federal limits on allowable concentrations of certain automobile emissions is described. The basic equipment for the testing comprises tanks of purging and calibration gas, a non-dispersive infrared analyzer with recorders, dynamometer instruments and driver's aid, a sunk test console, and digital computer and typewriter. Personnel required to operate the test facility are two driver-mechanics, a quality control engineer, and an analyzer-operator. A complete test consists of three cycles, the first being a 'dummy' run to ensure proper engine conditioning; each cycle in turn consists of ten operating conditions, or modes, which require 137 seconds to complete. A vehicle fails the test if the emission level exceeds 275 ppm hydrocarbons and/or 1.5% carbon monoxide content; or if spark timing, idle rpm, distributor vacuum and/or idle CO content exceed the specified limits. Rechecks and adjustments are made on any vehicle which fails; if it does not then pass re-testing, the carburetor and/or distributor are replaced. An important aspect of the quality control program is the series of controls exercised at the plants that supply auto components; these controls are particularly carefully applied to suppliers of carburetors and distributors and at engine-building plants.

6564 APTIC NUMBER 16011

Klochko, A. I.
DETERMINATION OF THE SPORE CONTENT OF THE AIR WITH STATIONARY PROBES. Mikol. Fitopatol., no. 1:87-93, 196. 12 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C., 10p., June 11, 1969.
CFSTI: JPRS 48213

Four methods for determining the spore content in the air were tested. The stationary probe was compared with an L-2 impactor, a slide on a vane placed at a 135 degree angle to the horizon, and a probe on a vane. It was concluded that the stationary probe was the most effective for determining spore content. The use of castor oil held the spores firmly and prevented them from being washed off by the rain. The number of spores in the stationary probe increases because of its vertical, stationary position which permits it to trap spores from side eddies and during weak air flows. At low wind velocities, the stationary probe is somewhat less sensitive than the impactor, but more sensitive than the slide. The main advantage of the stationary probe over the impactor is its simplicity, low cost, and freedom from the need for electric or mechanical power. The probe uses wind energy as a means of transferring spores. Impactors are usually clumsy, expensive, and unreliable in operation. They work poorly under dusty conditions and require electric or mechanical power, thus limiting their use in the field. The

stationary probe is designed solely for work in the field. Its advantages over the other spore catchers fit it for large-scale use in a network of stations for forecasting crop diseases.

6565 APTIC NUMBER 16388

Koch, H. W.
REPORT OF EXPERIMENTS FOR DETERMINATION OF THE SIZE OF SOOT PARTICLES PRODUCED BY VARIOUS ROCKET FUELS. (Versuchsbericht ueber die Ermittlung der Teilchengroesse von Rauchpartikeln bei verschiedenen Raketentreibstoffen). Text in German. Deutsch-Franzoesisches Forschungsinstitut Saint-Louis, 11p., 1967. 4 refs.
CFSTI: N69-17238

A test facility was used for soot measurements consisting of a combustion chamber where the rocket propelling charge was ignited. The developing rocket jet was mixed in a mixing chamber. The soot particles were carried by an air stream produced by an air compressor with a speed of 5m/sec through another chamber to the measuring tube. The latter had a diameter of 300 mm and a length of approximately 30m. The soot particles were caught at three points with so-called whisker meshes (5 mm disks with bronze meshes which had overlapping whiskers produced by an oxidation process). Three rocket propellants were used for the experiments: D40, a slowly burning mixture developing a heat of 850 kcal/kg and a pressure of 80 kgf/sq cm; D43, which burns with medium speed developing a heat of 990 kcal/kg and a pressure of 120 to 130 kgf/sq cm; and D41/2 A1, a fast burning pulverized rocket propellant containing 2% aluminum powder, with a heat of 1100 kcal/kg and a pressure of 275 kgf/sq cm. The results showed that it suffices to catch the soot particles at just one spot. Also, the filters were exposed for too long so that the load was too large. An exposure time of 1 second after ignition somewhere between the 60th and 90th second is recommended for future experiments. Comparison with soot particles received at the detonation of C2H2/O2 shows that the latter mixture produces larger particle sizes, namely 0.8 to 0.27 micron with a maximum of 0.33 micron vs. 0.04 to 0.22 micron, with a maximum of 0.075 micron at the propellants used here. The particle size is influenced by the temperature in the flame zone, the pressure, the oxygen content, the chemical nature of the propellant, and the original distribution of the propellant.

6566 APTIC NUMBER 16499

Kochman, Arthur F.
DEVELOPMENT OF THE DISPLAY METHODOLOGY FOR AN AIR-POLLUTION COMMAND AND CONTROL SYSTEM. Proc. Symp. Info. Display, 9th, Tech. Session, Los Angeles, Calif., May 1968:27-41. 1 ref.

The display methodology is presented for an air-pollution command and control system under development. To place the development display efforts in their proper context, reviews are provided of adapredictive control systems, recent hybrid modeling efforts, and the overall plan for integrating the air-pollution research program. The intent of the display methodology is to conceptualize and exercise a man-machine interface which utilizes cathode ray tube displays and which works in conjunction with a digital-processor. The display device employed for study is an IBM 2250 display unit and an IBM 360/65 processing complex. Task descriptions necessary to generate display formats are in three operational modes: real-world displays, adaptive displays, and predictive displays. The device has both a 'look-back' and 'lock-ahead' capability. The look-ahead capability is a convenient mechanism for investigating the immediate future without necessitating complete time, day, month, and year entry. The look-back capability enables an historical information retrieval process to take place. The three subcategoreis of the display are automobile, power plant, and industrial source. The automobile source status display will indicate traffic volume and traffic displays at selected traffic sensor points. The power-plant status display will indicate the fuel types, kilowatt hours output, and the status of pollution control equipment. Sources generating industrial contaminants will be identified by class of operation, volume, and pollution-control equipment status.

6567 APTIC NUMBER 16338

Lahmann, Erdwin, Guenter Menk, and Manfred Mceller
EQUIPMENT FOR AUTOMATIC AIR SAMPLING. (Geraete fuer automatische Luftprobenahmen). Text in German. Wasser Luft Betrieb, 13(12):467-468, Dec. 1969. 3 refs.

Two apparatuses are described which can be attached to automatic, program controlled samplers utilizing an impinger. The first apparatus records the volume sampled per unit time and prints it out, together with the date and the hour of the day. The second apparatus measures pressure and temperature during sampling and indicates the sampled volume under standard conditions. The recorder is the most expensive component of the unit, but it can be used for other tasks too. The automatic sampler with these two novel accessories can be used both for air quality measurements as well as for stack sampling.

6568 APTIC NUMBER 16303

Lahmann, Erdwin and Karl-Ernst Prescher
USE OF HIGH VOLUME SAMPLER FOR GRAVIMETRIC DETERMINATION OF DUST CONCENTRATIONS IN ATMOSPHERIC AIR. (Beitrag zur gravimetrischen Bestimmung der Staubkonzentration in atmosphaerischer Luft mittels Filtergeraeten) (High Volume Sampler). Text in German. Wasser, Luft Betrieb, 11(11):677-78, 1967. 10 refs.

To obtain first-hand information on the collection efficiency and reliability of the high volume sampler, experiments were conducted with a Staplex sampler for retangular filters of the dimensions 20/25 cm (effective filter area 18/23 cm). Glass fiber filters were inserted that had a specified average collection efficiency of more than 99.99% for aerosol particles less than 0.3 micron (inflow velocities 5 and 27 cm/sec). The filters were dried before and after use at 105 C. With this high volume sampler, 80 to 100 cu m air per hour can be drawn in. The air throughput is measured by a rotameter. Readings are taken at least twice, at the beginning and at the end of sampling. Intermediate readings become necessary at heavy loading of the filter with dust. To

avoid this, and also any errors at the determination of the sampled volume, a high volume sampler was equipped with a quantometer. The measured volumes indicated by the counting mechanism of the gas flow meter and the quantometer differed by + or - 2% at air throughputs between 70 to 90 cu m/h. The accuracy of the weight determination of loaded filters depends on the weight change by the filter. It was found that the filters lost on the average 4.3 mg of weight + or - 2.4 mg due to loss of fibers at the insertion and removal of the filter from the sampler. The detection threshold was found to be 0.14 mg dust/cu m air at a one hour sampling time (30 cu m throughput/hour) and 0.006 mg/cu m air at 24 hours of sampling time. To test the reproduceability of the sampler, two units were set up next to each other and the standard deviations were calculated with the measured results. At the sampling site concentrations of 0.02 to 0.30 mg dust/cbm air, the standard deviation was + or - 0.01 mg/cu m.

6569 APTIC NUMBER 16075

Lawrence, J. D., Jr., M. P. McCormick, S. H. Melfi, and D. P. Woodman
OPTICAL RADAR STUDIES OF THE ATMOSPHERE. Office of Naval Research, Washington D. C., Geography Branch; Air Force Cambridge Research Labs., Bedford, Mass.; Army Research Office, Durhar, N. C.; Army Engineer Topographic Lab.; Geological Survey, Washington, D. C.; and Dept. of Agriculture, Washington, D. C., Agricultural Research Service, Proc. Symp. Remote Sensing Environ., 5th, Ann Arbor, Mich., 1968, p. 609-616, 13 refs. (April 16-18, Paper 4864-18-X.)
CFSTI, DDC: AD-676-327

Optical radar investigations of the lower atmosphere are described. Rigorous Mie theory calculations of clear atmosphere volume backscattering cross sections were presented for four laser wavelengths. Two ruby laser radar systems were constructed and used to probe the lower atmosphere. The airborne system installed in a jet aircraft consisted of a ruby laser transmitter and a refracting telescope in which the axes were aligned parallel. The ground-based system consisted of a ruby laser and a 1.52 meter parabolic search light mirror positioned in a steerable mount in which the axes were parallel. A fast decrease in aerosol number density in the first 2 kilometers was observed in the clear atmosphere. Scattering from about 2.5 to 12 kilometers was predominantly of molecular origin. A small deviation from molecular scattering appeared at about 12 kilometers and increased to about a factor of 2 to 19 kilometers. The two sets of experimental data agreed well and also agreed with the model calculation above 2.5 km. Below 2.5 km, the measured profile deviates significantly from the calculated profile. This deviation is indicative of the aerosol concentration in the vicinity of a subsidence inversion which existed in the vicinity of 1.8 km. Since the laser backscattering technique can detect very small aerosol concentrations, it constitutes an excellent method for observing the concentration in the vicinity of temperature inversions and a technique for detecting temperature inversions in both the troposphere and stratosphere. No systematic observations were made of cloud systems. However, results clearly demonstrate that laser radar constitutes an excellent method for observing cloud systems. The method is also useful in determining turbulent regions of the atmosphere. Turbulence was not encountered where no enhancement in backscattered signal was evident.

6570 APTIC NUMBER 16087

Leithe, W. and A. Hofer
DETERMINATION AND OCCURRENCE OF SMALL CONCENTRATIONS OF N2O IN WASTE GASES, IN THE AIR AND IN WATER. (Ueber die Bestimmung und das Vorkommen niedriger Konzentrationen von Distickstoffoxid in Abgasen, in der Luft und in Waessern). Text in German. Allgem. Prakt. Chem. (Vienna), 19(3):78-79, March 1968. 7 refs.

A new method for the analysis of low N2O concentrations is briefly outlined. The method is a form of gas-liquids-chromatography (GLC) with separating columns made of propylenecarbonate-glutarcnitrile on Sterchamol. With the aid of a hot wire detector, 50 ppm N2O in 10 ml gas samples can still be determined with accuracy. Using this method, the formation of N2O was studied at the combustion of NH3-air mixtures over platinum-rhodium and the N2O concentration in the waste gases from nitric acid scrubbers was determined. Concentrations of 400 to 900 ppm N2O were found in the combustion gases, and of about 200 ppm in the waste gases before it was blown into the air. To adjust the GLC method to the determination of low N2O concentrations (e.g. 0.2 ppm), a concentration method was devised in which a concentration column filled with silica gel was activated at 160 C, making it possible to determine the concentrations usually found in the atmosphere. Analysis performed with this method in the vicinity of Linz (Austria) showed concentrations of 0.23 plus or minus 0.04 ppm. The N2O concentrations in various rivers and in drinking water were also determined. The apparatus is illustrated and a step-by-step account of the procedure is given.

6571 APTIC NUMBER 15509

Lewis, H. D. and A. Goldman
THEORETICAL SMALL-PARTICLE STATISTICS: A SUMMARY OF TECHNIQUES FOR DATA ANALYSIS WITH RECENT DEVELOPMENTS IN DATA COMPARISON, NOTATION, AND MIXTURE THEORY. Los Alamos Scientific Lab., N. Mex., Contract W-7405-ENG,36 R-LA-3656, 54p., 1968. 38 refs.

Methods are developed for analyzing particle size data generated by various devices for measuring particle size distribution. The data are classified as microscopic count and sieve analysis data, and methods for computing and comparing sample statistics are developed for functional and nonfunctional representatives of the classified data. An attempt is made to demonstrate the compatibility of recognized statistical notation and definition with the problem of particle size data analysis. Theorems for predicting maximum packing density illustrate the importance of using particle size statistics to explain process behavior of particulates. A general theory, and required notation, is presented for describing mixtures of particulate systems, with emphasis on the practical relationship between mixtures proportioned by component weight, frequency or numbers of component particles, and the two categories of data forms. Application of the general theory for mixtures in a study of packing behavior of particulate systems is discussed. Formulae for computing and comparing sample statistics generated by the various particle size measurement methods are summarized in

tables for both single-component systems and mixtures. (Author abstract modified)

6572 APTIC NUMBER 16102

Lieberman, Alvin and Peter Schipma
AIR-POLLUTION-MONITORING INSTRUMENTATION. IIT Research Inst., Chicago, Ill., Technology Center. Contract NASw-1716, NASA SP-5072, 74p., 1969. 520 refs.

The air pollution monitoring technology developed in NASA aerospace research and development programs is surveyed and the industrial applications of this technology discussed. The thirty-two instruments and techniques developed for aerospace needs are found to be novel improvements in the area of air pollution monitoring. They include spacecraft-cabin atmosphere monitors, such as the small general purpose cycloidal-focusing mass spectrometer, the nonmagnetic flight mass spectrometer, trace-gas analysis procedures, the colorimetric glycol detector, the hot-wire detector for chemically active materials, microwave spectroscopy, contaminant sensors, and the photoionization source for a mass spectrometer; hazardous gas and trace gas analysis, such as gas chromatograph to mass spectrometer transfer systems, techniques for measuring nitrogen in argon, hydrogen-gas-detection systems, hazardous-gas-sampling systems, gaseous hydrocarbon monitors, and hydrogen detectors; clean assembly-area monitoring, such as automatic aerosol particle counters, increased sampling-rate monitor systems, flight-qualified aerosol particle counters, increased sampling rate monitor systems, flight-qualified aerosol particle counters; contaminants in fluids, such as ultrasonic particle counters and non-volatile residue nephelometers; and biosphere studies, such as air samplers for minute particles and the Wolf Trap Mars microbe detector. A summary of the state of the art of air pollution monitoring is included, so that the aerospace-developed items can be compared to current practice; such as gas and vapor analysis (spectrographic, thermal conductivity, and chromatographic analysis) and control methods (absorption, adsorption incineration, and catalytic combustion).

6573 APTIC NUMBER 16166

Lieberman, Alvin
REFRACTIVE INDEX EFFECTS ON OPTICAL PARTICLE COUNTER RESPONSE. Svensk Farm. Tidskr., 73(2#):823-827, 1969. 7 refs.

Certain precautions that must be considered when using optical particle counters for analysis of viable materials are discussed. The problem areas considered are based on certain characteristics of optical particle counters. First, these instruments are non-specific in that all materials in the atmosphere are counted, both inert and viable. Thus the physical phenomena occurring with the background materials must affect the validity of readings with an optical particle counter. Secondly, the effect of particle refractive index on the particle counter response is discussed. The value of using optical particle counters is pointed out, although no direct correlation between optical particle counter readings and viable levels can be expected. (Author abstract modified)

6574 APTIC NUMBER 16080

Lindvall, Thomas
MEASUREMENT OF ODOROUS AIR POLLUTANTS. (Bestamning av luktande luftfororeningar). Nord. Hyg. Tidskr., 47(21):41-71, 1966. 91 refs. Translated from Swedish. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 44p., Aug. 14, 1969.

Methods for determining odorous air pollutants are described, with special emphasis on the organoleptic principle. The physiological and psychological background of odor is considered incompletely investigated. Existing knowledge of the organoleptic principle of measurement permits an approach to the problem of odors from the viewpoint of environmental hygiene. The most important dimension of an odor is its acceptability, but a quantitative determination cannot be obtained. Consequently determination of odor threshold is done by studying the number of dilutions necessary to arrive at odorlessness. Difficulties connected with psycho-physical studies include lack of individual consistency, effects of adaptation, and background variables of climatological, psychological, and biological origin. Different psychometric methods including principles of stimulus presentation and indicator response in threshold studies. Principles of direct scaling of supraliminal intensities, and different kinds of olfactometers were discussed. Odor thresholds for pure substances given in literature are not compatible. This is probably because of inaccuracy of the physical/chemical methods of analysis, lack of conformity in definitions, exposure equipments psychometric methods, selection of subjects, and statistical treatment. There may also be an interaction between different odorous compounds, with respect to the resulting strength of smell, that is not always a simple matter of addition. Annoyance effects are considered to be best studied by epidemiological methods where a reliable description of the exposure can be obtained. (Author summary modified)

6575 APTIC NUMBER 16076

Lloyd, D. T., P. Crosby, and B. W. Koerber
THE W.R.E. VISIBILITY METER. Weapons Research Establishment, Adelaide, S. Australia, Dept. of Supply, TM-PAI 265, 23p., March 1969. 9 refs.
CFSTI: N69-32474

A portable field instrument was developed for the measurement of meteorological range or visibility. The instrument is a compact, rugged, low cost version of earlier W.R.E. integrating nephelometers. Measurements of meteorological range were obtained in a small, local sample of the atmosphere. Accuracy is at least 10% in dry weather, over the range of visibilities between 2.5 and 50 miles. The principles, description, maintenance, and operation of the instrument is discussed. The visibility meters were subjected to long periods of continuous operation and found satisfactory. It was also suitable for operation under conditions of reduced pressure. Several flights were made with a visibility meter installed in an unpressurized aircraft. The purpose of the

flights was to obtain measurements of visibility in the lower layers of the atmosphere, and to determine the upper limit of visibility measured by the instrument. Airborne measurements showed that the visibility meter saturates at a value of meteorological range equal to 75 miles. Thus valid estimates of visibility may be obtained by operating the instrument in the range of 2.5 to 50 miles. The visibility meter could also be a useful supplementary instrument for use in studies of air pollution. It provides a means of monitoring the total pollution in an air-sample at any time. Variations of pollution through the day and from day to day can readily be measured with the instrument. It can also be used for optical tracking of missiles for which it was primarily developed.

6576 APTIC NUMBER 15749

Ludwicka, Antonina
THE PROJECT OF NORMALIZED METHOD FOR DETERMINATION OF VAPORS OF BENZYL CHLORIDE IN AIR. (Projekt znormalizowanej metody oznaczania par chlorku benzylu w powietrzu). Text in Polish. Med. Pracy (Warsaw), 20(4):425-429, 1969.

Two standardized methods for the determination of benzyl chloride vapor in air were discussed which use nitration or pyridine. The nitration process consisted of nitrating benzyl chloride to form 2,4-dinitrobenzyl chloride. Methyl ethyl ketone was added to extract 2,4-dinitrobenzyl chloride. Potassium hydroxide was then added and the resulting violet color determined the concentration. The reaction of warmed pyridine and sodium hydroxide or benzyl chloride resulted in a yellow-orange solution which also determined the concentration. The analysis for both methods was 1 mg/cu m or 5 mg/cu m, depending upon the amount of air sampled.

6577 APTIC NUMBER 12887

Ludwig, C. B., R. Bartle, and M. Griggs
STUDY OF AIR POLLUTANT DETECTION BY REMOTE SENSORS. General Dynamics Corp., San Diego, Calif., (122)p., July 1969. 124 refs.

The feasibility of detecting the major air pollutants by earth-oriented, satellite-borne sensors is investigated. The major pollutants considered are carbon monoxide, sulfur dioxide, ozone, ammonia, nitrogen dioxide, typical hydrocarbons, and peroxyacetyl nitrate (PAN). The spectral region considered extends from the ultraviolet to the microwave region. Considerations of the number of species accessible to optical detection, the matter of day and night detection, and of specificity indicate that the infrared region extending from 3.5 microns to 13 microns is the most useful one. A discussion of the pollutant species, their occurrence, formation, chemistry, concentration levels, and distribution profiles through the atmosphere is given. The problems of detection in the UV and visible regions, in relation to aerosol and molecular scattering, are discussed. Calculations of signal changes expected for an ideal Rayleigh atmosphere are presented. Some considerations of aerosol (particulate) pollution detection are discussed. Then, the radiative transfer of the thermal emission of the earth and atmosphere under the influence of meteorological conditions is investigated. Signal changes arising from the difference in radiation levels due to clean and polluted atmospheres are calculated and found to be usually more than 1%. A performance evaluation of eight different spectroscopic instruments for the remote detection of pollutants is made. These include radiometers, grating spectrometers, Fourier-transform interferometer-spectrometers, three instruments based on optical correlation methods, microwave radiometers, and one active system--a satellite-based laser. Two instruments, which are based on optical correlation methods (matched filter and selective chopper), have the greatest potential for near-future application. (Authors' abstract modified)

6578 APTIC NUMBER 16285

MacDowall, Joseph, Andrew J. Moffat, and Herschel H. Slater
THE USE OF AN AIRBORNE SPECTROMETER FOR THE RAPID SURVEY OF ATMOSPHERIC SO2 AIR POLLUTION. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 23p., 1969. 5 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 62nd, New York, June 22-26, 1969.)

An aerial survey of the area down-wind of a coal-fired generating plant in Tennessee was conducted using an airborne spectrometer. Pibal wind observations were obtained during the course of the survey. The meteorological conditions observed were those which would favor the transport of sulfur dioxide from the plant to the city. The airborne survey observed the plume on seven traverses at distances up to 20 miles down-wind of the plant. It was concluded that sulfur dioxide from the generating plant followed the mountain slopes which formed the eastern side of the Sequatchie-Tennessee River Valleys. Significant portions of the plume were neither observed to cross the Cumberland Plateau, which lies between the plant and Chattanooga, nor to enter the Tennessee River Gorge, which courses the Plateau. The experiment demonstrated the capability of the remote airborne detection device to track a sulfur dioxide plume for nearly 20 miles. It indicated the potential usefulness of the airborne system for making rapid, near-synoptic area surveys for air contaminants. Such surveys, if appropriate weather data are collected simultaneously, can provide data for rationally selecting air quality measuring sites. The device represents a potential for gathering information on the location of the emission sources, their source strength, and variations in the rates of emission. (Author abstract modified)

6579 APTIC NUMBER 16217

Manea, Alexe
THE OPTICAL METHOD FOR DETERMINING THE SMOKE DEGREE OF EXHAUST GASES. (Masurarea gradului de fum al gazelor de evacuare prin metoda optica). Text in Romanian. Construct. Masini, 19(8-9) 474-475, 1967. 5 refs.

A comparative index of combustion taking place in a motor is provided by determining the amount of smoke contained in the exhaust gases. Measurements were taken of the transparency of a column of burnt gas traversed by a constant luminous flux. The smoke content, expressed as a percentage of the minimum

transparency, is the relationship between (1) the variation in luminous flux as the column of burnt gas moves through the column and (2) the initial luminous flux traversing a column of air of the same length. The smoke meter is equipped with a vacuum photocell in which the current produced has a linear relationship to the values of luminous flux over a relatively wide interval of its operation. The disadvantage of the small current produced is remedied by an amplifier. The smokemeter used comprised a metal tube, an incandescent lamp, and a photoelectric cell. Measurements of smoke content are made while the gas column is in motion; to prevent the density of the sample from increasing, the outgoing orifice is made twice as large as the intake. The length of the column analyzed is 500 mm, which increases the sensitivity of the apparatus when the smoke content is low. The gas intake is placed at right angles to the direction of the current, along the diameter of the exhaust tube, to compensate for variations in smoke content in the fraction. The intake is mounted near the exhaust manifold so as to prevent errors due to the entrainment of carbon particles along the wall on the way to the exhaust. An electronic bridge amplifies the current and serves as the means of measurement and interpretation.

6580 APTIC NUMBER 16016

Marsh, K. J.
THE MEASUREMENT OF AIR POLLUTATION AROUND OIL REFINERIES. British Petroleum Co., Middlesex, England, Rept. of the Working Group 'Stack Height and Atmospheric Dispersion', Concawe, The Hague, Netherlands, 15p., Jan. 1968. 13 refs.

Principles of air pollution measurements are summarized to guide oil refineries in planning emission measurements and analyzing emission data. Pollutants considered are sulfur dioxide, hydrogen sulfide, mercaptans, smoke, solids such as grit and acid smuts, nitrogen oxides, hydrocarbons, ozone, and other oxidants. The advantages of using new commercial instruments for continous or consecutive measurements at fixed sites are contrasted with discontinuous methods using discrete samples. To determine the long-term pollution pattern around a refinery, data must be accumulated for a number of years and cumulative frequency curves derived for various concentrations of a pollutant at each measuring point. Such a curve can be used to determine the 'dosage' at each point and the damage caused by pollution. The effect of wind direction on pollution measurements must also be determined. To do this, measurements at each point are grouped according to the principle wind directions, a cumulative frequency curve is derived for each group, and concentrations obtained from the curve are plotted on vector diagrams similar to wind roses. These vector diagrams will tell whether changes in frequency distribution of pollutants are due to refinery operations or variations in weather.

6581 APTIC NUMBER 16308

Martens, Alexander
DETECTION OF AIRBORNE PARTICLES USING LIGHT SCATTERING. Svensk Farm. Tidskr., 73(28):828-839, 1969. 7 refs.

Commercial particle counters measure particle size indirectly by relating it to the magnitude of scattered light flux due to a particle in the sensitive volume. The scattered light is a complex function of particle size, shape, material, surface properties, orientation in the sensitive volume, and of the optical configuration of the counter. Of these functions, particle material is especially significant; depending on the optical configuration of the counter, there can be as much as an order of magnitude difference between the actual and the apparent size of a spherical particle. Of the five light scattering regions, three are useful for particle detection: right angle, near-forward, and forward regions. Optical systems are usually designed to collect the scattered light primarily from only one region. Unlike other particle counters, these instruments collect the light simultaneously from many particles contained in a relatively large volume of air. The others measure the light scattered by individual particles passing through a very small sensitive volume. Despite problems in particle sizing, these automatic counters compare favorably with manual techniques. They are especially useful in continuous or frequent measurements of contaminants and pollutants, and in rapid analysis of size distribution.

6582 APTIC NUMBER 16436

Meszarosne Nagy, Agnes
ULTRAMICROSCOPIC INVESTIGATION OF ATMOSPHERIC AEROSOL PARTICLES. (A legkori aeroszol-reszecskek ultramikroszkopos vizsgalata). Text in Hungarian. Idojaras (Budapest), no. 4:239-242, 1967. 6 refs.

Various types of ultramicroscopes offer excellent opportunities for the investigation of the physical properties of atmospheric aerosols. Ultramicroscopy may be used to study aerosol particles imbedded in gaseous surroundings without disturbing the equilibrium conditions existing among the particles and the gas. The technique may also be used to detect particles invisible in a normal optical microscope. One of the most essential problems is the determination of particle size or at least a lower limit of those detectable by the instrument. This problem was solved by executing simultaneous measurements by ultramicroscopic and by membrane filter methods. The smallest particles visible in the stream flow type ultramicroscope possess a radius of 0.058 micron. By using an ultramicroscope, the spatial distribution of the particle concentration can be determined. Measurements showed that the spatial distribution follows Poisson's law. (Author abstract modified)

6583 APTIC NUMBER 16057

Mount, W. D., A. C. Amway, C. V. Wick, and C. H. Haloy
CAPABILITIES OF MILLIMETER WAVE RADIOMETERS FOR REMOTELY MEASURING TEMPERATURE PROFILES PERTINENT TO AIR POLLUTION. (FINAL REPORT). Sperry Rand Research Center, Sudbury, Mass., Contract PH 86-67-76, SRRC-CR-68-19, 63p., 1968. 5 refs.
CFSTI: PB 186189

Analytical and experimental results are presented for low-level air temperature profile measurements with a ground-based wave radiometer. These low-level profiles play an important role in dispersing or trapping air pollutants, but their direct measurement with available instrumentation requires tall towers, instrumented aircraft, ballons, or radiosondes. These methods are a hazard to aircraft, have data reduction and processing problems, cannot provide vertical soundings, and are not sufficiently sensitive to low-level conditions important in air pollution control. A ground-based devise overcomes these limitations. The millimeter wave radiometer detects natural radiation coming from oxygen molecules in the atmosphere. The measured amount of radiation is proportional to the ambient temperature of the oxygen molecules. Radiation characteristics of these molecules allow the altitude at which the upper air temperature is measured to be varied by tuning the radiometer to different frequencies. Experimental results show a one-to-one correspondence exists between the radiometric and the radiosone and/or tower data output for superadiabatic and other lapse temperature conditions. A measure of the height and magnitude of temperature inversions was also obtained remotely with the radiometric techniques. The radiometric magnitude of the inversion is consistently less than that measured directly, but, as yet, no attempt has been made to correct for this bias. Both the analytical and experimental results establish the feasibility of remotely measuring in real time the atmospheric stability conditions pertinent to air pollution.

6584 APTIC NUMBER 15969

Mukherii, Anil K., T. Erdman, M. M. Trieff, and K. L. Gabriel
EVALUATION OF THE ADSORPTION PROPERTIES OF MOLECULAR SIEVE 569 COATED WITH 10% WT/WT TRITON X100. Preprint, Drexel Inst. of Technology, Philadelphia, Pa., Dept. of Chemistry and Drexel Inst. of Technology, Philadelphia, Pa., Environmental Engineering and Science Program, 11p., 1968. 1 ref.

The usefulness of molecular sieve 569 coated with 10% Triton x-100 as a dessicant for removing moisture from a gas stream was established in experiments which showed that water had no effect on the elution of benzaldehyde, pentyl acetate, n-butyl alcohol, or hexane at 50 C in a gas chromatographic column. In experiments with an uncoated sieve, hexane was retained by the column at 50 C. At 100 and 200 C no desorption was observed. When the coated sieve system is run for 30 min at 2.5 l/min flow rate, quantitative recovery for hexane and butanol is about 100%; for petyl acetate, 85%; for benzaldehyde, 70%. When the system is run longer than 30 min, all recoveries approach 100%. Recommended procedures for regenerating the coated sieve are given. Use of the coated molecular sieve for collection of organic components present in air are discussed.

6585 APTIC NUMBER 16512

Narjes, Ludwig
DUST SAMPLER EQUIPMENT FOR QUASI-ISOKINETIC SAMPLING BY MEANS OF NOVEL ZERO-PRESSURE PROBES. Chem. Age India, 19(8):595-603, Aug. 1968. 9 refs.

In large power plants with steam generators fired by pulverized fuel, complicated dust problems often necessitate precise supervision of individual dust streams and local dust distributions. The zero-pressure probe by which the static pressure of the main and sampling streams can be equalized is a suitable instrument for this purpose. The application of the probe for sampling high concentrations of dust in coal-dust streams and the behavior of the probe under diverse in-flow conditions in an inclined dust-conveying channel are presented. By evaluating the amount of dust at fixed points of the cross section, it is possible to investigate the distribution of dust density. The particle size analyses are converted according to the diagram of quantitative dust distribution and are entered on 'relative segregation' graphs.

6586 APTIC NUMBER 16398

Noyes, Claudia Margaret
STUDIES OF THE DETERMINATION AND REACTIONS OF SULFUR DIOXIDE AS AN AIR CONTAMINANT. Colorado Univ., Boulder, Thesis (Ph. D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1966, 56p. 38 refs.

Analytical methods for sulfur dioxide determination, including colorimetric and conductrometric methods, were evaluated, and the reactions of sulfur dioxide with hydrocarbons and nitrogen oxides at high dilution in air were studied. Radioactive S(35)O2 was used as a tracer to follow SO2 in the gas phase and after its absorption in the sampling solution. The West-Gaeke colorimetric method gave slightly less color but better reproducibility and sample stability than the Helwig-Gordon method. Liquid scintillation counting showed that the dilute hydrogen peroxide-sulfuric acid solution used for absorbing SO2 in the Thomas conductometric method was also less sensitive and less reproducible than the West-Gaeke colorimetric method. It was emphasized that the use of bubblers in series is not necessarily a reliable method for measuring absorbing efficiencies of solutions for gases. None of the mixtures showed any measurable amount of reaction of SO2 in dry or moist air in the dark during residence times as long as three weeks. Since there was a reaction of SO2 in an irradiated mixture containing both NO2 and hexene in dry air but none with either NO2 or hexene alone, it seemed probable that SO2 reacts with a product of the hexene-NO2 photolysis. There was no appreciable SO2 reaction in an irradiated mixture with benzene alone or in the presence of NO2. All products of the SO2 reactions were absorbed, since both color and counts were low in the gaseous aliquots taken from flasks immediately after irradiation. Whether the SO2 is oxidized or held in some form not detectable by colorimetric analysis is not known. It is definite that those reaction products which do not react as SO2 in the colorimetric determination do not remain in the gaseous phase. (Author abstract modified)

6587 APTIC NUMBER 15569

O'Keeffe, Andrew E. and Gordon C. Ortman
PRECISE PRIMARY STANDARDS IN AIR POLLUTION ANALYSIS. Preprint, Public Health Service, Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, 8p., 1965. (Presented at the American

Chemical Society, Division of Water, Air, and Waste Chemistry, Atlantic City, N. J., Sept. 12-17, 1965.)
A method is described for producing the low concentrations of pure gases needed in air pollution research. The method comprises immersing an inert plastic tube in a diluent gas and then sealing the tube. Permeation of the gas through the walls of the tube proceeds at an easily measured and constant rate, making simple primary standards suitable for use in field or laboratory available. To establish the validity of the method, propane, n-butane, nitrogen dioxide, and sulfur dioxide were studied in detail. FEP Teflon tubes gave constant, reproducible gas. Data illustrated the constancy and reproducible permeation. Using these tubes, predetermined concentrations of gases can be generated, by several combinations of techniques. Most simply, a tube is weighed before and after immersion in a known volume of gas. More satisfactorily, weight loss is determined following exposure to an accurately metered constant flow of gas. When less precision is required, weighing can be eliminated by exposing a tube with a predetermined effusion rate to either a known volume or a known flow of diluent gas for a prescribed time. When a very low concentration is desired, an aliquot portion of a tube can be used. Permeation tubes provide an analytical chemist with primary and working standards for checking new methods and assuring the accuracy of results obtained with established methods. They also provide readily transportable calibration standards.

6588 APTIC NUMBER 16143

Ohdaira, Toshio
STUDY OF THE MEASURING INSTRUMENT BY ELECTRIC CONDUCTIVITY METHOD FOR SO2 CONCENTRATION IN THE ATMOSPHERE. (Dodenritsuho ni yoru taikichu aryusan gasu sokutei sochi no kosatsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(10):607-612, Oct. 15, 1967. 4 refs.

In the automatic recorder used to monitor sulfurous acid gas in Tokyo since 1962, air is passed through a hydrogen peroxide solution and the change in electric conductivity due to the presence of sulfurous acid is detected by a platinum electrode. After its amplification, the change in conductivity is recorded automatically. The apparatus frequently fails to function properly. Measurements made from 1963 are discussed and suggestions given for improving the accuracy of future measurements. If the measuring rate is lower than 80%, mean values cannot be calculated. This happens more than six hours a day. Although eight points must be considered in measurements, that necessary to calculate mean values for more than 10 months in a year was not recorded in 1963. Another point was unrecorded in 1964 and two in 1965 and 1966. To measure sulfurous gas accurately by this method, the following factors should be examined: the flow of the reaction liquid, the flow of air for examination, and the flow of output. Corrective measures to be taken in the event of accidents are described. Also emphasized is the need of spare parts for the equipment and adequate personnel for maintenance supervision.

6589 APTIC NUMBER 15954

Oshio, Toshiki
AIR POLLUTION PROBLEMS IN JAPAN (II). (Wagakuni niokeru Taikiosen to sono Mondaiten (II). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(9):547-556, Sept. 15, 1968.

Pollution measurement methods in coastal industrial areas are discussed, together with problems in air pollution control. To obtain a standard evaluation of solid-state contaminants like dust fall, it has been customary to measure rapidly sedimenting, rough atmospheric dusts of comparatively wide diameter. However, since the energy source has shifted from coal to heavy oil and facilities to collect dust fall have improved, a study of the behavior of dust particles was begun. What is important now is the effective removal of these particles, which should be examined in the interest of health protection and environmental preservation. Collection rates of dust samplers are less significant. Compared to dusts of 0.2-0.5 micron size, which do not remain in the respiratory system, dusts of 10-20 microns have faster sedimentation rates and are usually absorbed in the oral cavity or throat. Dust particles of 1-2 microns easily reach the bronchi or the deepest part of the lungs and have high retention rates. These dusts cannot be satisfactorily collected by air samplers nor detected by electronmicroscopes. Diffusion and dilution of the dusts need to be examined. In coastal industrial areas, dust diffusion and dilation are closely related to wind velocity, which controls dust behavior to a great extent.

6590 APTIC NUMBER 16369

Poetzl, K.
TRACE ANALYSIS OF CA IN DUSTS AND AEROSOLS. (Spurenanalyse von Ca in Staeuben und Aerosolen). Text in German. Naturwissenschaften (Berlin), 53(3):1-2, 1966. 5 refs.

A carrier method for the trace analysis of calcium is described. The cadmium ion (1.03 A) the radius of which is similar to that of the Ca ion (1.06 A) was used as carrier for an oxin precipitation of the Ca ion at a pH of 12. The filter ash was mixed with 1.5 g KNaCO3-borax (50:15) and dissolved in 25 ml H2SO4. The solution was filled up to 100 ml. The interfering substances such as Mo, Fe, and Ti, compounds were removed. After that, 5 mg of Cd ions along with 50 mg oxin were added to 20 ml of the above solution. Drops of NaOH (5N) were added until a pH of 12 was obtained. At a pH of 4.5 to 7, oxin and the Cd oxinate as well as Al precipitated. At a pH of 9 to 10, they dissolved again and could thus be used as indicators. Some further drops of NaOH precipitated the Cd oxinate with the entire Ca ions in crystalline form. The precipitation was filtered and washed with oxin water, upon which 5 ml 2N HCl was added. The solution was filled up to 50 ml. The Ca emission was measured in the flame photometer at 620 mm.

6591 APTIC NUMBER 16133

Preining, Othmar, Ruth Baumann, and Franz Moser
RESULTS OF SC2-MEASUREMENTS MADE WITH THE 'ULTRAGAS 3' AND BY THE

WEST-GAEKE METHOD, CARRIED OUT WITH THE AID OF A CALIBRATION GAUGE. (Ergebnisse von SO2-Messungen mit dem 'Ultragas 3' und nach der Methode West-Gaeke, durchgefuehrt mit Hilfe eines Eichkanals). Text in German. Staub, Reinhaltung Luft, 29(11): 443-446, Nov. 1969. 5 refs.

Recording instruments used for monitoring air pollution require quantitative checking of the measured values in addition to mechanical servicing. This requirement is satisfied with a gas-generating apparatus or a calibration gauge. The instrument records SO2 concentration with accuracies of 0.05 mg per cu m, as compared with 0.03 mg per cu m using the West-Gaeke method. The calibration gauge is portable and allows the instrument to be checked outdoors at the measuring sites. (Author summary modified)

6592 APTIC NUMBER 14449

Prochazka, Rudolf
CONTINUOUS DUST MEASUREMENT IN WORKING PLACES AND INDUSTRIAL PLANTS. (Kontinuierliche Staubmessung an Arbeitsplaetzen und Industrieanlagen.) Text in German. Arch. Eisenhuettenw., 39(6): 439-447, June 1968. 18 refs.

The new continuously-measuring and recording unit ('Konitest') for dust concentrations operates on the principle of static electricity. In its original design, the unit comprises two rings made of teflon and quartz which develop contact potential, a cylindrical tube and a radial vane imparting a spinning motion on the axially-entering dust/air mixture. Three more versions of this unit have been developed. The main characteristic of version 1 is a tangential inlet which sets the gas flow in motion. Version 2 is a venturi tube made of material with contact potential. Version 3 has a grid made of material with contact potential installed into the cylindrical body. The air flow is directed by an axially-arranged vane. This version is primarily suited to measure the higher dust concentrations of industrial waste gases. With all of these units, the current which is measured depends on the material used for the electrodes. (Metal, for instance, produces a current of + 0.000000003; several other examples are listed.) Study of the influence of the grain size of the dust particles showed that the potential of a dust particle is proportional to its surface. Continuous measurements of the dust concentrations in blast furnace waste gases were taken with the Konitest. The unit was further used to measure dust concentrations on working places in an ore sintering plant and in a foundry. The measurements are described in detail. The threshold of the Konitest is 1 micrometer/cu m. Further measurements of very low dust concentrations in the dust sphere of Le Bouchet and on the Zugspitze are discussed.

6593 APTIC NUMBER 16527

Rathburn, Carlisle B., Jr. and Arturo F. Miserocchi
A PORTABLE INSTRUMENTED TOWER FOR USE IN METEOROLOGICALLY RELATED RESEARCH. J. Econ. Entomol., 62(1):149-154, Feb. 1969.

Portable equipment for the simultaneous measurement of wind velocity, wind direction, temperature, and relative humidity at 1, 5, 10, 20, and 40 ft is described. All instruments are mounted on a collapsible 3-section tower attached to a 2-wheel trailer. Temperature and humidity measurements are made by calibrated wet and dry thermistors. Wind velocities are recorded at the five stations by cup anemometers and wind directions at 10- and 40-foot stations, by electric wind vanes. The equipment is suitable for field research associated with the biology and control of insects requiring measurements of meteorological factors at various heights. Because of variations due to wind velocity and actual percent relative humidity, humidity measurements may not be acceptable for all applications. However, these variations could undoubtedly be eliminated by the constant aspiration of the thermistors. (Author abstract modified)

6594 APTIC NUMBER 16522

Rimberg, David and Jess W. Thomas
COMPARISON OF PARTICLE SIZE OF LATEX AEROSOLS BY OPTICAL AND GRAVITY SETTLING METHODS. J. Colloid Interface Sci., 32(1): 101-105, Jan. 1970. 11 refs.

The particle size of several latex aerosols (0.557 to 1.947 microns) was obtained by two experimental methods. One method was the measurment of particle penetration through a gravity settler using an optical counter for low-concentration aerosols and a light-scattering photometer for high-concentration aerosols and interferring particle size from these measurements. The other method was to use the particle sizing capability of the optical counter directly. Experiments with the gravity settler indicated that the latex aerosols in the size range 0.5-1.1 micron were rather monodisperse, despite an apparent heterodispersity shown by the optical counter measurements. The 1.947 micron aerosol showed heterodispersity by the optical counter and settler methods. This was found to be due to the high concentration of atomized emulsifier. Temperatures up to 180 C did not affect the size distribution of aerosols. (Author abstract modified)

6595 APTIC NUMBER 16272

Rinehart, Gayle S.
FOG DROP SIZE DISTRIBUTIONS - MEASUREMENT METHODS AND EVALUATION. Army Electronics Command, Fort Monmouth, N. J., Task 1T061102B53A-20, ECOM-5247, 39p., April 1969. 44 refs.
DDC: AD 690787

Several published methods of measuring the size distribution of fog droplets were reviewed. A laboratory study showed that neither impaction nor natural settling was entirely reliable. Capture or replication media which included polyvinyl alcohol, gelatin, oil, and silicon fluid do not always record droplet impressions or retain droplets smaller than 4 micron for lengthy periods. Lack of correlation between the number of captured droplets and visibility were present even in the most careful determinations employing impaction methods. It appeared that either small droplets were not captured and replicated, or that factors other than scattering by water droplets contributed heavily to the deterioration of visibility in fog. During a fog dispersal test, pyrotechnically

produced hygroscopic reagents were observed to cause an increase in the number of concentrations of the small sized droplets of a natural fog. During nonfog conditions, several types of pyrotechnic flares containing different hygroscopic reagents were tested for usefulness as fog modification agents. Measurement of drop and particle size distributions down-wind from the ignition point of these pyrotechnics revealed that the effects of small droplet sizes in decreasing visibility in air of high humidity would negate the improvement made by removal of large size drops. (Author abstract modified)

6596 APTIC NUMBER 16349

Russkikh, A. A.
TRIETHYLAMINE DETERMINATION IN THE ATMOSPHERE. (Opredelehiye trietilamina v vozdukhe). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 10:36-38, 1969. 2 refs.

A colorimetric method for the determination of triethylamine in air, based on the reaction with citric acid and acetic anhydride, was proposed. The sensitivity is 5 micrograms per ml of the initial solution. Ammonia in an amount up to 0.5 mg did not interfere with the determination. Ten to fifty mg of ethylamine, dimethylamine, aniline, methylaniline, ethylaniline, diphenylamine, ethanolamine, or diethanolamine failed to react with citric acid and acetic anhydride and did not affect the triethylamine determination. The tertiary fatty and aromatic amines and amino alcohols, such as trimethylamine, diethylaniline, dimethylethanole amine, diethylethanolamine, and triethanolamine do react with citric acid and acetic anhydride. The proposed method can be used for the determination of trimethylamine in the air. The sensitivity is also 5 micrograms per ml of the initial solution. The sensitivity for determining amino alcohols is 10 micrograms per ml of solution.

6597 APTIC NUMBER 16132

Saitoh, Takeshi, Takamichi Hiramatsu, Tatsuyuki Takahashi, Yasunori Takemoto, and Akira Ochiai
INFLUENCE OF ENGINE VARIABLES ON EXHAUST EMISSIONS FROM AUTOMOBILE ENGINE DURING ACCELERATION. Bull. Sci. Eng. Res. Lab. (Tokyo), no. 45:70-82, 1969. 1 ref.

A method was developed to test transient performance of automobile engines on an engine test bench equipped with an inertia wheel and a dynamometer controlled by an analogue computer. The air-controlled disc brake and the clutch actuator were incorporated in this acceleration equipment to simulate the start of the vehicle. Accuracy and reproducibility of the equipment and method were satisfactory. The influence of engine variables on the concentrations of CO and hydrocarbon in the engine exhaust was studied with this acceleration simulator. The CO and HC concentrations during acceleration were the same as the exhaust composition of the steady running engine. As a consequence, exhaust compositions during acceleration could be estimated from those in the steady state.

6598 APTIC NUMBER 16170

Scherber, F. I. and J. H. Stoudenmire
A MOBILE TEST STATION FOR MOTOR VEHICLE EXHAUST. Bendix Tech. J., 2(3):94-100, Autumn 1969. 4 refs.

The design of a fully integrated mobile test station was described with emphasis on test-cycle criteria and instrumentation techniques. Key components and functions performed in the test facility include nondispersive infrared spectrometers for carbon monoxide, carbon dioxide, and hydrocarbon analyses, variable-flow, fixed-dilution, or variable-dilution sampling, a chassis dynamometer for engine loading, and integrated circuits on printed-circuit cards for sensor signal conditioning. Also included are reed switches driven by the program clock for sensor scanning, a keyboard for manual inputs, and the best available diagnostic sensors for engine diagnosis. One of the most important factors governing selection of a suitable testing cycle is the time restriction imposed; no more than five minutes may elapse between drive-on and drive-off with hard copy test data. A procedure under consideration is a high-speed conditioning cycle followed by a medium speed surveillance cycle, the total test time being 155 seconds. Exhaust emission levels must be capable of direct correlation with Federal standards in order that a meaningful pass or fail status can be readily assigned to each vehicle tested. A number of approaches to the automation of vehicle-exhaust gas analysis were proposed which call on a variety of techniques, among them analog, digital, and hybrid schemes which vary in complexity with the intended application. Visual aids in the test vehicle and on the mobile laboratory control panel will permit both the vehicle driver and the dynamometer operator to monitor the test-cycle modes. The gas levels measured for each mode of the test cycle will be automatically recorded on punched cards for immediate computation of concentration and mass-per-mile values. The Friez Data Center will be used to interface the analog outputs of the analyzers with the punched card terminal equipment. The modular concept utilized in the design of the Friez Data Center permits its adaptation to a wide variety of systems configurations. All functional circuits are contained on plug-in printed-circuit cards which can be selected on the basis of the characteristics required to provide any specified over-all system performance.

6599 APTIC NUMBER 16105

Schreiber, Erich and Othmar Skatsche
DEVICE FOR DETERMINING THE SOOT CONTENT OF FLUE GASES. (Hans List, Graz, Austria) U. S. Pat. 3,464,257. 3p., Sept. 2, 1969. 2 refs. (Appl. Feb. 14, 1967, 3 claims).

Conventional methods of determining the soot content of flue gases rely on a series of marked filter paper plates. Because the visual reading instrument must be adjusted by hand, the methods are complicated and time consuming. In addition, there is the risk of confusing the blackened filter plates. In the present invention, soot content is determined by the degree of blackening of a filter traversed by a predetermined amount of flue gases taken from the flue gas current of an internal combustion engine by a sampling pipe. A filter tape crosses the sampling pipe in a rhythmic

motion; its blackening is measured by an adjacent photoelectric instrument. All control functions are automated, precluding individual sources of error. This automatic control ensures extreme precision in the removal of predetermined amounts of flue gas at the required time intervals. Continued recording of successive flue gas samples on the filter tape permits the surveillance of flue gas samples without interrupting the operation of the machine. Samples can be measured immediately at the test bench by examining the relative light transmittance of the tape, or the tape can be evaluated in another place at a later date. The instrument can be hand-operated or remote-controlled as required.

6600

APTIC NUMBER 16431

Shaffernocker, Wayne M. and Charles M. Stanforth
SMOKE MEASUREMENT TECHNIQUES. Preprint, Society of Automotive Engineers, Inc., New York, 1968. 21 refs. (Presented at the Society of Automotive Engrs., Air Transportation Meeting, New York, April 29-May 2, 1968, Paper 680346.)

The measurement of the smoking characteristics of jet engines and jet engine components is necessary to evalute the relative merits of proposed methods of smoke reduction, identify sources, and estimate the visibility of the exhaust plume. Several techniques used to collect data over a wide range of environment are evaluated. These include optical systems, quantitative gravimetric systems, and soiled tape methods. Many soiled tape methods are compared, and a calculation procedure is described for making a direct comparison of any two methods. A soiled tape method described in detail uses a spot meter which filters smoke through Whatman paper and produces a smoke number that is based on the diffuse reflection from the filtrate produced by filtering 0.3 cu ft of smoke through a square inch of filter paper. This technique is an economical method of accurately measuring large volumes of smoke under various conditions. Current optical systems do not have sufficient sensitivity to evalute low smoke concentrations. (Author abstract modified)

6601

APTIC NUMBER 16421

Slavka, V.
MONITORING THE QUANTITY AND TYPES OF POLLEN PARTICLES IN THE FREE ATMOSPHERE BY THE IMPACT METHOD. (Sledovanie mnozstva a druhov pel'ovych zrn vo vol'nom ovzdusi impaksnou metodou). Text in Czech. Pysiat. Reumatol. Vestn., 46(3):158-165, 1968. 11 refs.

A new method for monitoring and comparing the quantity of pollen particles in the atmosphere as a function of time, wind speed and direction, air temperature, duration of sunlight, amount and density of precipitation, and other meteorological conditions was developed and tested. By providing a more complete picture of atmospheric distribution of allergens, the method makes it therapeutic programs for sufferers, particularly during the acute stage. At the same time, regions can be evaluated as to suitability for treatment of inhalation allergies. The instrument used for this method samples the air always in the direction of the wind, pollen particles being collected on a glass plate covered with an adhesive layer. Pollen counts are made by microscope.

6602

APTIC NUMBER 16127

Solomon, William R. and Jeanne A. Gillian
A SIMPLIFIED APPLICATION OF THE ANDERSEN SAMPLER TO THE STUDY OF AIRBORNE FUNGUS PARTICLES. J. Allergy, 45(1):1-13, Jan. 1970. 14 refs.

An application of the Andersen sampler to the study of potentially allergenic, culturable, airborne fungus particles is described. For this purpose, a highly modified technique with a single culture plate beneath stage 6 (S6 arrangement) was evaluated and found to produce a telescoped collection qualitatively comparable with growth obtained by conventional 6 plate arrays. The S6 arrangement also appeared to yield quantitatively valid results if optimally short sampling periods were chosen. Up to 3 per cent of particles, capable of growth on the media used, were noted to bypass the S6 plate after entering the intake orifice. However, these losses were not necessarily related to particle size. Significant impaction of particles upon sampler hardware was not suggested, and withdrawal of plates from the upper stages appeared to obviate adventitious deposition at those points. Increased particle recoveries were obtained when the sampler was made wind oriented, with the advantages being shown most clearly for genera having relatively large spores. Qualitative comparisons between collections made simultaneously by the open-culture plate method and by the wind-oriented Andersen sampler confirmed the latter's major theoretical advantage in recovering small-spored genera. (Author abstract modified)

6603

APTIC NUMBER 16407

Stoeber, W. and U. Zessack
THE MEASUREMENT OF PARTICLE SIZE SPECTRA WITH THE AID OF CENTRIFUGAL SEPARATORS. (Zur Messung von Aerosol-Teilchengroessenspektren mit Hilfe von Zentrifugalabscheidern). Text in German. Zentr. Aerosol Forsch. (Stuttgart), 13(3/4): 1-19, Dec. 1966. 10 refs.

The fundamentals of particle size spectrometry of airborne particles are discussed with the aid of the sedimentation properties of particles in the gravitational field. There are two methods of analyses: the elutriator method; and the spectrometer method. In the first case, a cumulative particle sediment is obtained from which the size distribution of the kinetic particle diameters can be calculated. In the second case, the particles are spatially separated according to kinetic diameter, and the size distribution can be experimentally determined. Both principles have been used in the construction of centrifugal separators for the determination of aerosol particle size spectra. The centrifuges operating according to the elutriator principle have the disadvantage that the particle sediment can be only approximately converted into a definite particle size spectrum. Only centrifugal separators which operate according to the spectrometer principle such as the 'conifuge' permit accurate determination of the particle size spectrum. An approximate solution for the calculation of particle trajectories and their

end points on the collection foil is given. The disadvantage of the conifuge is seen in the low throughput so that a long sampling time is required at low (atmospheric) aerosol concentrations. Two units are described which avoid the disadvantage. The annular slot conifuge is suitable for higher throughputs. The ribbon shaped collecting surface of the spiral spectrometer has a smaller surface.

6604 APTIC NUMBER 16543

Terabe, Motoji
METHODS FOR MEASURING GASEOUS AIR POLLUTANTS. (Yudoku gasu no kenchi sokutei to sono kanren kiki ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(7):453-45?, Aug. 15, 1966. 5 refs.

Measurements of air pollutants are roughly classified as chemical, physical, and biological. Chemical measurements are subdivided into test-paper, colorimetric, test tube, titration, gas volume, weight methods, etc. Physical methods are subdivided into mechanical, electrical, and optical method. Biological measurements make use of the human nose, small animals, and plants. The measuring methods are also classified according to time interval into integral, instantaneous, and continuous measurements. The collection method for test samples is divided into absorption tube, vacuum substitution, air substitution, liquid substitution, and automatic continuous gas sampler method. The absorption tube method and gas sampler used by National Air Sampling Network of the U. S. are discussed in detail. Sulfur oxides are measured by the West and Gaeke method, the lead dioxide method and recorded by the electric conductivity method. Nitrogen oxides are measured by the Saltzman method, the Yacobs method, and test tube methods, and recorded by an automatic recorder. Hydrogen sulfide is measured by the methylene blue method and recorded by an automatic recorder. Carbon monoxide is measured by hopcalite according to a test tube method, detected by Kitagawa detector, and recorded by an automatic recorder. Ozone is measured by iodimetry, phenolphthalein, ferrous thiocianate, the gum crack method, and an ozone meter. The operation of each instrument is reviewed.

6605 APTIC NUMBER 16590

Thompson, B. J.
APPLICATIONS OF FRAUNHOFER HOLOGRAMS. Inst. of Electrical and Electronics Engineers, New York, IEEE (Inst. Elec. Electron. Engrs.) Annu. Symp. Electron, Ion, Laser Beam Tech., Berkeley, Calif., 1967, p. 295-303. 17 refs. (May 9-11.)

Fraunhofer holograms are formed by the coherent addition of the Fraunhofer (far-field) diffraction pattern of an object and a background; the background illumination is usually provided by light transmitted by the area surrounding the object but may be supplied as a separate reference beam. This rather specialized form of holography has important applications in the determination of particle-size distributions in the range from a few micron and upwards. Records of dynamic situations may be captured by using a pulsed ruby laser as a light source. The technique was applied to a variety of particle sizing problems, including the measurement of naturally occurring fog and test chamber and laboratory aerosols. Other areas of interest are in bubble-chamber photography and shock wave recording. This technique was also suggested for interferograms and schlieren photography. (Auther abstract modified)

6606 APTIC NUMBER 16363

Vizioz, J. -P. and W. Leuckel
METHODS AND INSTRUMENTS UTILIZED AT THE F.R.I.F. EXPERIMENTAL STATION FOR THE MEASUREMENT OF DIFFUSION FLAMES. (Methodes et instruments utilises a la Station Experimentale de la F. R. I. F. pour des mesures dans les flammes de diffusion). Text in French. Riv. Combust., 23(9):427-437, Sept. 1969. 4 refs. (Presented at the Conference 'I Problemi della Combustione - Bruciatori' de l'Associazione Termotecnica Italiana, Milan, June 18-19, 1969.)

The investigation of turbulent diffusion flames is a highly complicated field of work, calling for a large number of experimental data. For this purpose, two square section experimental furnaces were built: one 6.5 m long and 2 m wide; the other, 10 m long and 1.5 m wide. The instruments used offered extremely quick measurement readings, were compact, and highly heat and corrosion resistant. Temperature was measured along the furnace walls and on the gases of combustion. To measure velocities, a Prandtl tube, parallel with the flame axis, was employed. To analyze the combustion products sampled at various points of the flame, the expedient was adopted of cooling them quickly to arrest the chemical combustion reactions. Chromatography was used to analyze H2, CO2, C2, N2, CH4, CO. Hydrocarbon levels were also assayed considered as C2, C3, and C4. To determine unburned solids, a sample of gas was filtered under isokinetic conditions. (Author summary modified)

6607 APTIC NUMBER 16389

Vogt, K. J.
MEASUREMENT METHODS FOR AIR MONITORING AND THEIR APPLICATION BY THE NUCLEAR RESEARCH INSTALLATION JULICH FOR AIR MONITORING. (Messmethoden der Luftueberwachung und ihre Anwendung bei der Umgebungsueberwachung der Kernforschungsanlage Juelich). Text in German. Ber. Kernforschungsanlage Juelich, no. 566, 39p., Dec. 1968. 14 refs.
CFSTI: N69-30626

For monitoring radioactive aerosols, air samples must be filtered to increase the activity. The advantages and disadvantages of fiber filters, electrostatic precipitators, cascade impactors, and continuous and discontinuous filters are discussed. A high efficiency can be obtained with fiber filters, but self-absorption is high. The collection efficiency of electrostatic precipitators is generally not very high for radioactive aerosols, but self-absorption is low so that even alpha emitters can be measured. Radioactive iodine is collected on filters impregnated with activated coal; tritium is adsorbed on silica gel or condensed on cold surfaces. Step filters are helpful to determine the time of a leak in nuclear installations. The air monitoring system of the

nuclear installations Juelich comprises a central station, 6 monitoring stations around the plant and 4 monitoring stations in the neighboring villages, a mobile radiation measuring station, and a meteorological observation bureau. At the central station, the dose rate and the gamma as well as beta plus gamma count rates are continuously measured with an ionization chamber and with shielded and unshielded counters. The short and long-term alpha and beta activity, the gamma spectra of aerosols, and the total beta activity of precipitations are measured. Moreover, the concentrations of Sr 89, Sr 90, Y90, Zr 95, J 131, Cs 137, Ba 140, Ce 141, and Ce 144 in the precipitations are measured. The hot particles in the fallout are studied. In the stations surrounding the plant, the environmental radiation is measured.

6608 APTIC NUMBER 16328

Volovik, G. A. and I. E. Lev
A NEW METHOD OF INVESTIGATING THE CONCENTRATION OF SULPHUR AND OTHER ELEMENTS IN LUMPS OF BLAST FURNACE COKE. Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), no. 2:18-22, 1969. 6 refs.

Specimens of ordinary coke, ferrocoke, and coke fluxed with ash that previously underwent petrographic analysis, were used to investigate the sulfur distribution in microvolumes of coke lumps. A microanalyzer was used to study the sulfur distribution in microvolumes of coke lumps. The x-ray microanalyzer recorded the intensity of the characteristic x-rays produced in the investigated specimen as a result of electron bombardment. The principle and operation of the instrument was described. The results showed that since nearly all the sulfur in ferrocoke will be transferred to the gaseous phase in the blast furnace when the coke burns at the tuyeres, sulfur will be absorbed by the sponge and the pig iron. This is bound to impair the desulfurization of the metal in the furnace. In fluxed-ash cokes, a high proportion of the sulfur combines with the lime. The use of cokes with lime additions in blast-furnace smelting ought to improve the transfer of coke sulfur to slag via the fluxed ash, which should facilitate the production of low-sulfur irons. The use in smelting of fluxed-ash coke together with fluxed sinter will enable the raw limestone constituent of the burden to be dispensed with in all furnaces and substantially improve the distribution of the sulfur between the iron and slag, thus enabling metal with a low sulfur content to be produced.

6609 APTIC NUMBER 16240

Wahnschaffe E.
CONTRIBUTION TO FORMATION OF SO3 AND SO2 IN FLUE GASES IN OIL FIRING SYSTEM. (Ein Beitrag zur Bildung von SO3 and SO2 in Rauchgasen einer Oelfeuerung). Text in German. Mitt. Ver. Grosskesselbesitzer, no. 100:166-73, June 1967. 11 refs.

The SO3 content in flue gases from an oil-fired steam generator were continuously measured using a sulfotherm, and the formation of SO3 and SO2 was studied. Flue gases with temperatures of 550 and 600 C were filtered and sent to the analyzer with temperatures above the dew point. The SO3 components were absorbed in condensating water vapor. The sulfuric acid which forms simultaneously with the sulfurous acid was thermally separated and cooled. Its electric conductivity which is proportional to the SO3 concentration in the gas was measured. The measurements showed that the SO3 formation is inversely proportional to the absolute temperature and directly proportional to the O2 content. Magnesium oxide proved to be best suitable for sulfur removal among the oxidation catalysts used as oil additives or blown directly into the firebox; however, it is uneconomical.

6610 APTIC NUMBER 15940

Wakamatsu, Shigeo
DETERMINATION OF ZINC IN STEELMAKING DUST. (Seikoro dasuto chu no aen no teiryo). Text in Japanese. Tetsu to Hagane, 54(7):787-795, June 1968. 45 refs.

A simple chelatometric titration method was developed for the determination of zinc in dust generated by steel-making processes. Zinc forms a negatively charged chloride complex which is adsorbed by the strongly basic anion exchange resion. Maximum adsorption of zinc is obtained in 2N HCL. In this medium, most elements with which zinc is associated in dust are not adsorbed by the resin. Therefore, it is possible to separate zinc from iron, aluminum, manganese, calcium, magnesium, chromium, and nickel. Zinc is then eluted from the resin with 0.3N HNO3 and titrated with EDTA, with EBT used as the indicator. A subsequent titration procedure obviates interference from adsorbed iron, copper, tin, lead, or arsenic. While having the same accuracy as gravimetric methods, the proposed method has the advantage of speed. (Author abstract modified)

6611 APTIC NUMBER 16314

Wanner, H. U. and A. Deuber
METHODICAL INVESTIGATIONS ON IDENTIFICATION OF BACTERIA IN AIR. (Methodische Untersuchungen zur Nachweis von Bakterien in der Luft). Text in German. Arch. Hyg. Bakteriol. (Munich), 153(4):316-325, 1969. 22 refs.

Two different measuring methods for the detection of bacteria in air were tested for their suitability for laboratory and field examinations. Using Grennburg-Smith impingers, the germs to be detected were concentrated in an absorption solution which was then used for innoculating cultures. The distribution of the bacteria, their lethality rates at different storage times and temperatures, as well as the deviations between simultaneously collected samples were examined in the two impingers operating in series. Using Slit-Samplers, an impaction method, the bacteria were directly blown on a solid culture medium. With these measurements, the deviations between simultaneous samplings performed at various places were determined. In the comparison of the impinger and impaction methods, partial differences between the determined germ concentrations were observed. (Author summary modified)

6612 APTIC NUMBER 16540

Watanabe, Shinya
SELECTION OF THE ODOR PANEL AND ODOR SURVEY BY THE PANEL. (Akushu hyoka paneru no sentaku to paneru chosa). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(9):557-562, Sept. 15, 1968. 21 refs.

Despite improvements in odor analizer techniques, a high level of skill is still required to evaluate the data obtained when two or more odors are mixed. It appears more accurate so far to rely on olfactory perception. An odor panel is described whose members possess an ability to identify odors with great accuracy and to grade odor concentrations. Determination of olfactory perception thresholds involves several procedures, including the widely recognized olfactogram. Another element which should be taken into consideration when selecting panel members is the individual tolerance limit of olfaction. Some persons may have a specific disposition or liability to perceive some odor. The selection of an odor panel, therefore, must be related to its objectivity; the judgment of panel members should represent that of the people or community concerned, regardless of their subjective interest. Panel size is generally determined according to its initial purpose and research scale. A mass panel composed of a thousand persons is conceivable. While examinations of individual physical and psychological factors would be difficult, such a panel would yield more accurate odor perception thresholds than smaller panels.

6613 APTIC NUMBER 16120

Willis, G. H., J. F. Parr, R. I. Papendick, and S. Smith
PESTICIDES IN AIR. A SYSTEM FOR MONITORING ATMOSPHERIC CONCENTRATIONS OF FIELD-APPLIED PESTICIDES. Pesticides Monitoring J., 3(3):172-176, Dec. 1969. 9 refs.

A system suitable for monitoring the atmospheric concentration of endrin in the field was described. Air is drawn through the portholes of a stainless steel boom at a rate of 1 liter/minute by a vacuum pump rated for continuous operation. The air passes through the boom into an ethylene glycol trap which removes pesticide vapors from the air. The air is exhausted from the trap through the vacuum pump and back into the atmosphere. The system is easily installed and can be readily modified to meet special conditions and experimental requirements. A laboratory study was designed to determine the suitability of ethylene glycol as a trapping solvent for volatilized endrin. More than 90% of the endrin was accounted for, and it was concluded that ethylene glycol would be effective. A field study revealed that volatilization could be a significant factor contributing to the net loss of endrin when applied to sugar cane. The mean atmospheric concentration of endrin reached a maximum of 540 ng/cu m during the 3-day period after application and decreased asymptotically to 30 ng/cu m 77 days later. Future studies of pesticide volatilization should be accompanied by measurement of several climatic variables including wind, temperature, and relative humidity profiles. The air sampling system should be useful in monitoring the atmospheric concentration of any chemical for which a suitable trapping solvent is available.

6614 APTIC NUMBER 16507

Wolstenholme, E. F.
METHANE DETECTION. Colliery Guardian (London), 217(1):47-54, Jan. 1969. 5 refs.

A recording methanometer and a specially designed recording airflowmeter were used to obtain continuous measurements of the total quantity of firedamp emitted from a longwall coalface. The sources and variations in total firedamp emission from a production longwall unit were also analyzed. Results showed it was possible to split the readings of firedamp emission into different trends and to correlate the results to coalface activities. Firedamp emissions from coal cutting operations were shown to be reasonably constant, whereas emissions from adjacent strata were found to be cumulative with time. The complex nature of the variations measured emphasize the inadequacies of spot measuring techniques. The results indicated numerous ways in which research into firedamp emission could be extended utilizing continuously measuring instruments. It was shown possible to continuously record the variations in air quantity circulating a unit and the variations in firedamp content of that air. By recording the variations in a number of units in a mine district and also recording the variations in pressure across the units, it would be possible to relate changes in firedamp emission to absolute values of coalface resistance. A set of instruments on the main return from the district could be used as a check on the total variations. The recording airflow meters were found to be reliable research instruments although requiring regular maintenance. The main hazard to their performance was the presence of dust which resulted in a loss of sensitivity. Regular laboratory checks, however, indicated that this did not affect the calibration. Definition of the normal sources variations, and magnitude of firedamp emission by the methods described, could prove an invaluable aid in increasing the confidence with which abnormal trends can be identified and analyzed.

6615 APTIC NUMBER 15678

Abel W., R. Jaenicke, C. Junge, H. Kanter, P. Rodriquez Garcia Prieto, and W. Seiler
AIR CHEMISTRY STUDIES AT THE OBSERVATORY IZANA (TENERIFFA). (Luftchemische Studien am Observatorium Izana, Teneriffa). Text in German. Meteorol. Rdsch., 22(6):158-167, 1969. 31 refs.

The particle size spectrum and the concentration of trace gases such as CO, N2O, and SO2 were measured in the clean air of Izana, Teneriffa in March of 1968. The observatory where the measurements were taken is located 2370 m above sea level. A large ion spectrometer was used for the measurement of particles with a radius of C.00005 cm. The particles with negative or positive charge were precipitated by an electric field and measured as electric current. Simultaneously the aerosol concentration was determined with a Scholz particle counter and with a photographically recording automatic particle counter. For particles with a diameter of 0.0008 cm the scattered light counter and a two-stage impactor were used. For larger particles than these a single-stage impactor was used. The chemical composition of the aerosols (SO4(--), Cl(-), NH4(+)) was determined by colorimetry. The CO concentration was determined by the HgO method. A molecular sieve was used to determine N2O, SO2 was drawn through a quartz tube filled with silica gel and analyzed in the laboratory. The samples for the particle counts and the N2O and SO2 determination were taken 1.5 m above the ground. The average CO concentration was 0.157 ppm, the average N2O concentration 0.27 ppm, and the average SO2 concentration 0.5 microgram/cbm (referred to a barometric pressure of 570mm Hg). The CO concentrations were considered high, and it was believed that the ocean was a CO source. The diurnal CO variation was less pronounced than over continental areas.

6616 APTIC NUMBER 16619

Adams, D. F. and B. E. Koppe
AN AIR QUALITY STUDY IN THE VICINITY OF LEWISTON, IDAHO, AND CLARKSTON, WASHINGTON. Washington State Univ., Pullman, Div. of Industrial Research, Rept. 65-138, 32p., 1962. 12 refs.

A one-year air quality survey in the vicinity of Lewiston, Idaho and Clarkston, Washington was conducted. Air samples were collected or measurement of dustfall, suspended particulates, soiling index, sulfation, hydrogen sulfide, and reducing gases. The survey area is characterized by a prevailing light easterly wind drift with occasional strong gusts accompanying the passage of self-developed frontal systems from the west. High valley walls, by limiting northerly or southerly dispersion, contain much of the pollutants within the valley. The study year was characterized by greater than normal turbulence, favoring dilution and wider dispersion of pollutants. Suspended particulate loadings ranged from average to excessive for urban areas, and values for downtown Lewiston and Clarkston were 1.6 times the average in a complex of commerical-industrial-suburban activity. The average values for soiling index were considered light. Analysis of the components of dustfall indicated a multiplicity of dust sources, including high background levels attributed to airborne soil particles swept in from adjacent areas. The heavy dustfall of downtown commerical areas contained a high percentage of self-generated material not related to a specific industrial source. Dustfall in suburban areas contained greater quantities of sodium, calcium, and sulfate than were found elsewhere and were probably related to kraft pulping. Data indicated a need for reduction of emissions of particulate matter of all kinds. Odorous sulfur gases were found throughout the areas with the highest levels in North Lewiston. Low-level inversions and synoptic, stagnating air masses were associated with ground-level fumigation of these gases. When such periods develop, the natural fog and the man-made pollutants become indistinguishable. Sulfation shows that a significant part of the sulfur content of the air arises from multiple community sources including comfort heating, vehicular travel, and waste disposal. Substantially higher levels of particulate and gaseous pollutants were obtained during the heating season, indicating that emissions resulting from combustion of fuels contributed significantly to overall air pollution. Winter meteorological stagnation, less favorable for dispersal of pollutants, also contributed significantly to the higher pollutant levels found during the heating season. (Author abstract modified)

6617 APTIC NUMBER 16478

CO2 MONITORED TO MEASURE POLLUTION. Am. Soc. Safety Engrs. J., 13(10):18-19, Oct. 1968.

Carbon dioxide measurements with a nondispersive infrared analyzer are reported. In the first of a two-part study, analyzers were placed at four California air-pollution monitoring stations to compare hourly, daily, and seasonal variations in CO2 with the amount of carbon monoxide, nitric oxide, nitrogen dioxide, and oxidant in the air. In the second study an analyzer was used in an automobile and aboard a ship to determine the extent of CO2 production from fossil fuels and accumulation in a variety of environments: the Los Angeles freeway system, a residential area, and an area of the Pacific Ocean. Results from the air pollution monitoring stations indicate that CO2 can be used to estimate chemical pollution in the air and meteorological patterns of the atmosphere. The data obtained show a strong positive correlation exists between the CO2 and CO and other indices of photochemical smog in daily and seasonal patterns. The meteorological pattern in the atmosphere is also reflected in the daily buildup of CO2. A four-month compilation of freeway data indicates that major roadways are a considerable source of pollution, with CO2 concentrations averaging more than 100 ppm higher than over the rest of the Los Angeles area. On cross streets, high CO2 concentrations were recorded up to one half mile away from the freeway; they increased rapidly on freeway approaches. Results of monitoring in a 13 sq mile area show CO2 dilution levels are exceeded by residential heating even in months that are only moderately cold. In the Pacific Ocean study, areas of high concentration as far out as 200 to 300 miles are attributed to prevailing wind conditions which carry contaminated air from San Francisco, Los Angeles, and San Diego. It is concluded that CO2 measurement is valuable in urban planning and development.



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6618 APTIC NUMBER 16322

Anechina, P., J. M. Romero Romero, B. Sanchez F. Murias, and J. De La Serna
EVOLUTION OF THE ATMOSPHERIC CONTAMINATION IN MADRID IN THE YEAR 1968. (Evolucion de le contaminacion atmosferica de Madrid en el ano 1968). Text in Spanish. Rev. San. Hig. (Spain), 43(9-10): 615-640, Oct.-Sept. 1969. 6 refs. (Presented at the Sociedad Espanola de Higiene y Medicina Social, Feb. 16, 1969.)

The results of atmospheric contamination studies carried out in Madrid 1968 as a continuation of those started in 1964 are reported. The mean concentration of sulfur dioxide over the four years was 142.9 micrograms/cu m. The mean maximum SO2 concentration per month was 516 micrograms/cu m in January. The mean maximum concentration per day was 784 micrograms/cu m, and 2.7% of the days, the concentration was greater than 500 micrograms/cu m. The mean fumes concentration per year was 238.6 micrograms/cu m. The mean maximum fume concentration per month was 870 micrograms/cu m in January. The mean maximum concentration per day was 1.785 micrograms/cu m, and 3.7% of the days, the concentration was greater than 750 micrograms/cu m. The fume rates in Madrid were higher than those in other European cities. (Author summary modified)

6619 APTIC NUMBER 16050

ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS. Army Tropic Test Center, Fort Clayton, Canal Zone, ARPA Order 740 and OCRD Proj. 2R025001A724 01, Semiannual Rept. No. 1 and 2, 173p., Oct. 1966. 016 refs.
AD 647823

This report reviews the accomplishments of an environmental data base project from September 1965 to August 1966. Five lines of investigation in the fields of microbiology and chemistry of the atmosphere were carried out, either in the Panama Canal Zone or the Isthmus of Panama: the deposition of microorganisms on surfaces; observations of the distribution of airborne microorganisms; the amounts and variabilities of chemicals in the atmosphere; an exploratory study of the roles of microorganisms as sources of atmospheric contaminants in the tropics; and several short-term observations on condensation nuclei and particulate matter in the atmosphere. The equipment and methods used in data collection are reported in detail. Data analyses include relationships between moisture content and dry density, moisture content and strength, soil temperature in verticle profile and air temperature, groundwater and rainfall in open and forest sites, and an analysis of seasonal variation in soil strength in open forest sites. A description of the project herbarium is included, and the capability of litter from grass, brush, and forest land to support fire is described. An inventory of plants is given in an appendix. Attention is given to the use of gas chromatograph to sense volatile organics in the atmosphere. Collected data are tabulated and tentative conclusions are presented.

6620 APTIC NUMBER 16636

Baikov, B. K.
HYGIENIC DATA RELATED TO SANITARY CLEARANCE ZONES FOR KORKINSK OPEN COAL PITS. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:188-190, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

The degree of air pollution with coal dust, sulfur dioxide, and carbon monoxide at different distances from the Korkinsk open coal pits was investigated. Air samples were collected on the lee side of the mine pit at 300, 500, 800, 1000, and 1200 m from the pits. Air samples for the determination of SO2 were collected by the aspiration method and determined nephelometrically, using a gas analyzer. Records were kept of the temperature, air humidity, wind direction and velocity, and barometric pressure. Results showed intense pollution with SO2 and dust. Sulfur dioxide concentrations exceeded the limit of allowable single concentration for atmospheric air of inhabited places by 260% at 300 m, and by 100% at 800 m. Dust concentrations exceeded the hygienic norm by 360% at 300 m and by 140% at 800 m. Carbon monoxide was present in trace amounts only. Residents in the vicinity complained of unpleasant odor and air dustiness. A sanitary clearance zone of 1000 m was recommended. The sanitary clearance zone could be reduced where sufficient hydro-mechanical installations are efficiently operated, provided that production processes and sanitary-hygienic protection means are under strict inspection and control.

6621 APTIC NUMBER 15600

Braja, M., G. Trompeo and G. C. Vanini.
FIRST INVESTIGATIONS ON THE POLLUTION OF THE AIR OF TURIN BY POLYCYCLIC AROMATIC HYDROCARBONS. (Prime ricerche sull'inquinamento de idrocarburi policiclici aromatici nell'atmosfera urbana di Torino). Text in Italian. L'Igiene Moderna, 62(1-2):27-45, Sept. 1969. 9 refs.

Polycyclic aromatic hydrocarbons (PAH), among the substances most frequently accused of cancerogenic powers, are the products of incomplete combustion. Due to the high boiling point of PAH (above 150 C), they easily condense into soot particles and are conveyed in this form, leading to a certain correlation with the dust content of the atmosphere. Results of PAH determinations were evaluated by gas chromotography, recently shown as superior to technical chromotography or spectrophotometry. Two types of sampling were used: protracted sampling when the air had a high dust content; and instantaneous sampling, at times of low dust content. Dust samples were collected every 14 days during the winter and spring, and once a month during the summer. A total of 110 samples were collected from 15 collecting points strategically located throughout the city. About 0.2 grams of dust from a sample was preserved in a plastic food bag in darkness, then placed in the flask, previously treated with acetone, of a Soxhlet apparatus, and extracted with 200 ml of cyclohexane for 16 hours. The cyclohexane was vacuum-evaporated at 35-40 C; the residue was dissolved in 10 ml cyclohexane and divided into two equal samples, one of which was added 0.1 ml of a standard solution of fluoranthene, chrysene, and benzopyrene.

These were treated according to the technique of Hoffman and Wynder. A residue of 0.1 ml nitromethane solution was obtained, 1 microliter of which was used for gas chromatography with the Perkin-Elmer model 801, using nitrogen as the transport gas. The present article is limited to an evaluation of the first 55 tests made. The following PAH were identified: anthracene, fluorene, chrysene, 1,2-benzanthracene, and 3,4-benzopyrene. An unknown group of peaks also appeared on the chromatogram which has been noted with chromatograms of auto exhaust gases, suggesting a possible relationship.

6622 APTIC NUMBER 16300

Carnuth, W.
MEASUREMENTS TAKEN IN AN ALPINE VALLEY STATION OF THE BEHAVIOR OF AN AEROSOL PARTICLE SPECTRUM UNDER THE INFLUENCE OF METEOROLOGICAL CONDITIONS. (Ueber das Verhalten des Aerosolpartikelspektrums in Abhaengigkeit von meteorologischen Einfluessen nach Messungen an einer alpinen Talstation). Text in German. Experientia, Suppl. vol. 13:52-59, 1967. 6 refs. (Presented at the Symp. Atmospheric Pollution and its Effect on Man, Saint Moritz-Bad (Engadin), June 18-19, 1966.)

Between March 1964 and February 1966 measurements (870 individual measurements) of the total aerosol content of the air were taken with a four-stage cascade impactor. The 50% cutoffs of the four stages are 12, 4, 1.5 and 0.45 micron. The first stage was not used for the evaluation because of the small particle concentration. To save time, the particles were counted without regard to size. The three particle numbers obtained were used for derivation of the size distribution law. Junge's law dn equals c D exp(-nu)dD was used, where dn is the number of particles per ccm with diameters between D and D equals dD, c the proportionality factor (particles per ccm and micron) and nu an exponent. The variable parameters c and nu are used to describe the prevailing particle spectrum. Comparison of the variation of c and nu during 1965 and 1966 shows that high c values occur in summer and in winter, minima in fall and in spring. The average of all 24 monthly averages of c is 0.79 particles/ccm/micron. A correlation with the amount of precipitation exists. The exponent nu shows a maximum fro fall to spring and a minimum in the summer months. This is explained by the influence of domestic heating in winter. Of the precipitations (rain, shower, and snow) affecting particle spectrums, showers are assumed to have the least influence and snow a high influence. Additional data might not support this conclusion.

6623 APTIC NUMBER 16310

Cataltas, Ihsan
INDUSTRIAL AIR POLLUTION AT KARTAL TERRITORY. Istanbul Tek. Univ. Bul., 22(1):25-41, 1969. 4 refs.

Measurements of dustfall, smoke, and sulfur dioxide are reported for the Kartal area of Turkey. This industrial region, 25 miles from Istanbul, contains cement, lime, and gypsum factories; asbestos-cement pipe and roof cover plants; iron, steel, and lead foundries; electric battery and lead oxide manufacturing plants; and an insecticide, herbicide, and fungicide manufacturing plant. Total dust deposit and cement dust were sometimes two or three times the maximum allowable concentrations (1000-15,000 mgr/sq m/day) in industrial areas and four to eight times the allowable concentrations (200-600 mgr/sq cm/day) in residential areas. Similarly, smoke concentrations were two to three times higher than allowable concentrations. Sulfur dioxide concentrations in the area were within acceptable limits because of meteorological and topographical conditions and the type of industries.

6624 APTIC NUMBER 16067

Dalmo Victor Co., Belmont, Calif.
STUDY OF INFRARED TECHNIQUES FOR MONITORING STACK GASES. (FINAL REPORT). Contract PH 86-65-61, R-3159-3954, 52p., Oct. 12, 1965.

The feasibility of pollution efflux monitoring by remote observation was investigated in an infrared spectral study of industrial stack plumes. Data were obtained by the addition of a telescope assembly to a commercial wide range, high sensitivity infrared spectrometer. The pertinent optical parameters of the instrument were measured with a series of elementary tests aimed at closely approximating the field usage. Emission spectral reference tests were performed with heated chambers of varying CO2, SO2, H2O, and air mixtures. The recorded spectra showed SO2 densities in different plumes ranging from 50 ppm to nearly 100%. It is concluded that the measurement of industrial stack pollution rates is feasible with simple optical systems using common optical components and relatively inexpensive detectors. A large number of parameters are significant in reception of radiation from a given plume. For a low temperature process, this can result in rather complex organics being generated which tend to clutter the spectra. Pollution densities over 0.3% are readily determined quantitatively for most gases when the plume temperature is over 200 F and when a small to moderate amount of particulate or other gray body radiation is present. Coal burning power plants are expected to show distinct SO2 spectra at densities as low as 50 ppm when the particulate exhaust is under control. (Author summary modified)

6625 APTIC NUMBER 15823

Einbrodt, Hans Joachim and Rudolf Liffers
COMPARATIVE LEAD OXIDE ANALYSES IN AIRBORNE DUST OF WEST GERMAN CITIES. (Vergleichende Bleioxidbestimmungen im Schwebestaub Westdeutscher Gross-Staedte). Text in German. Staedtehygiene (Uelzen/Hamburg), vol.8: 4p., 1967. 15 refs.

Dust measurements were taken in Muenster, Hannover, and Oberhausen. The last city is located in the industrial center of the Ruhr Valley; the other two cities are primarily residential areas with some medium-sized industries. Three measurement series were taken. In addition to the lead concentration, the following areas were determined; the airborne dust concentration; the moisture content at 150 C; the ashing loss at 400 and 750 C; and the silicon,

aluminum, iron, and calcium concentrations. However, only the results of the lead analysis and the dust concentration measurements are discussed. The highest suspended dust concentration was measured in Oberhausen as 0.46 mg/cu m. The most frequent concentrations were 0.1 to 0.2 mg/cu m (on 41% of the total measuring days). The maximum dust concentration in Hannover was 0.3 mg/cu m, the most frequent concentrations were between 0.05 mg/cu m and 0.1 mg/cu m air. In Muenster, the maximum concentration was 0.233 mg/cu m. The same sequence was observed for lead concentration in these cities. Thus it can be assumed that the traffic density decreases in like manner. The maximum PbO concentration measured in Oberhausen was 3.0 micrograms. In Hannover, the absolute PbO quantities fluctuated between 0.13 microgram/cu m and 2.25 micrograms/cu m. No lead was measured on 62% of the measuring days in Muenster; 20% of the measured concentrations fluctuated between 1 and 1.5 micrograms/cu m. No relationship could be found between the dust and lead concentrations.

6626 APTIC NUMBER 15789

Einbrodt, H. J., W. Klosterkoetter , and H. Reploh
STUDIES OF THE QUANTITY AND CHEMICAL COMPOSITION OF AIRBORNE DUST IN A LARGE RESIDENTIAL AREA. (Untersuchungen ueber Menge und chemische Zusammensetzung des Schwebestaubes in einer Wohngrossstadt). Text in German. Arch. Hyg. Bakteriol (Munich), 149(5/6):401-407, 1965. 32 refs.

In the city of Muenster, fust fall was measured with an electrostatic precipitator from June to November 1963. The samples were taken 10 m above the ground. The silicon, aluminum, iron, calcium, lead, and sulfur contents of the dust samples were determined, as well as the ashing loss at 360-400 C. Dust concentrations of more than 0.150 mg/cu m were rare and occurred only at low wind speeds; temperature and brief periods of precipitation had no influence. The lowest dust concentrations were measured with winds from NW to NE. An average concentration of 0.125 mg/cu m with winds from the S to W (Ruhr area) was measured. The highest dust concentrations was measured when the winds came from the center of the city, namely from NE to SE (0.348 mg/cu m). The most frequent ashing loss was 40 to 60%. The absolute SiO2 content per cu m air was more than 30 micrograms. The absolute Al2O3 content was between 10 and 20 micrograms/cu m air. The SiO2:Al2O3 ratio was not constant. The Fe2O3 content was on the average one-third that of SiO2 content. When CaO was found, it was in the concentration range of the Fe2O3. The lead content fluctuated greatly; the maximum was 2.65 micrograms/cu m with the majority of measured concentrations ranging from 0.3 to 1.4 micrograms/cu m. The total sulfur content fluctuated between 2.5 and 8.5 micrograms/cu m (this included SO2 and SO3). No dependence of the sulfur content on the wind direction could be found.

6627 APTIC NUMBER 16112

Entzian, G.
DUST SEDIMENTATION MEASUREMENTS IN THE REGION OF GREEN FODDER DRYING PLANTS. (Staubsedimentationsmessungen im Bereich einer Gruenfuttertrocknungsanlage). Text in German. Z. Ges. Hyg. (Berlin), 15(11):847-849, Nov. 1969. 5 refs.

Dust sedimentation measurements were made at drying plants of the type UT 66-1. From the results, it was concluded that a minimum distance of 250-300 meters should be maintained for the establishment of other buildings. Emission measurements for prototypes of standardized emitting plants were proposed. The results are to be published. (Author summary modified)

6628 APTIC NUMBER 16221

Frankenberger, Ernst
STANDARD VISIBILITY IN QUICKBORN/HOLSTEIN AND THE EXCHANGE OF OBSCURING AEROSOL. (Ueber die Normsicht bei Quickborn/Holstein und den Austausch von trueebendem Aerosol). Text in German. Ber. Deut. Wetterdienstes (Frankfurt), 15(106):1-22, 1967. 20 refs.

The standard visibility was recorded with scattered light recorders close to the ground, at 1.7 m, and at several meters above the ground. The measuring station was 20 km north of Hamburg and 1 km west of Quickborn. The radio towers of Quickborn recorded continuously the wind temperature and humidity. The measurements were taken in the summer of 1965. Evaluation of the results showed that after elimination of aerosol swelling through the relative humidity, a log-normal distribution was obtained with a standard deviation 0.7 times that of the unreduced values. About 14% of the aerosol was washed out by 1 mm of rain. Over dry weekends, about 36% of the aerosol settled until 5 p.m. Sunday. The soil is a source for obscuring aerosols with a diurnal contribution of 14% of the total atmospheric aerosol concentration. The industrial production contributes about 17% per day. In the second half of the night, considerably higher quantities of aerosols fall out than in the first half, although no measurable precipitation occurs. With winds coming from the North Sea with a speed of more than 10 m/sec, 10 to 20% of the aerosols are of maritime origin.

6629 APTIC NUMBER 16544

Fukaya, Morihei
PROGRESS OF SMOKE DUST CONTROL AND PROSPECTS FOR FUTURE. (Baien kisei no keii to kongo no ayumi). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(1):18-22, Jan. 15, 1966.

Four years have passed since the Smoke Dust Control Act was enacted in Japan. The degree of air pollution control that has been achieved in these years is discussed, together with general trends in pollution control. In Japan, an area is designated as polluted on the basis of dust fall, sulfur dioxide concentration distribution from local sources of smoke dust, fuel consumption per area, assessed smoke dust per area, and weather and meteorological conditions. Owing to control measures, the average smoke dust in pollution areas has decreased in recent years. However, SO2 pollution has increased, due to the transition from coal to heavy oil. Emergency measures are taken for SO2 control when one of the following conditions are met: a dense fog caution is announced by the Weather Meteorological

Agency; a noticeable temperature inversion is observed; and wind velocity on the land is on the average less than 3 m/sec in early morning and evening. SO2 continues to exceed 0.2 ppm. There are 11 observation centers in Tokyo, 12 in Osaka, 9 in Kanagawa, and several in other industrial areas, where SC2 is continuously measured by automatic recorders. Smog alert issuance is based on the data reported from those centers, and the frequency of issuance is currently increasing. Suggestions are made for issuing an ambient standard and revising the SC2 emission standard, considering specific gaseous pollutants and their emission standard together countermeasures, controlling gas odors, and adopting a telemetering system for a continuous supervision.

6630 APTIC NUMBER 16266

Hudson, Gerald
AIR QUALITY SURVEY. EL PASO METROPOLITAN AREA. Texas State Dept. of Health, Austin, Div. of Occupational Health and Radiation Control, PHS Grants 69B-4701-SI and 69B-4707-RD, 160p., 1969. 12 refs.

An air sampling program was conducted from Oct. 17, 1968 to Nov. 17, 1968 to determine ambient air quality for the El Paso Metropolitan Area. The concentration and location of air pollutants present in the lower atmosphere were determined. The pollutants monitored were particulate matter, sulfur dioxide, hydrogen sulfide, carbon monoxide, total hydrocarbons, aldehydes, nitrogen dioxide, and ozone. Twenty five fixed sampling sites were chosen in representative locations throughout the area. There were numerous occurrences during the survey of periods of atmospheric stagnation which caused a buildup of pollutants. The period for the survey was deliberately chosen to coincide with the period of the year having the greatest frequency of atmospheric stagnation. A desire to obtain measurements of maximum air pollutant concentrations was a major factor in making this choice. Concentrations of suspended particulates were greater than the ambient air standard of 200 micrograms/cu m 28% of the time. The sulfur dioxide ambient air standard was 0.2 ppm for 24 hr and 0.4 ppm for any 30 min period. Sulfur dioxide readings monitored during the survey were less than or equal to 0.15 ppm 97% of the time. Concentrations were greater than 1.0 ppm for 30-minute averages on two occasions. Concentrations of greater than 0.5 ppm for one hour were found less than 0.2% of the time. Carbon monoxide values ranged from 0 to 18 ppm, depending on traffic volume. The ambient air standard was not set. Standards for total hydrocarbons were not set either, but hourly averages ranged from 0-10 ppm. It was concluded that the El Paso area has an air pollution problem and the major pollutants are particulate matter, sulfur dioxide, carbon monoxide, and total hydrocarbons. Promotion of air pollution control and control methods were recommended, as well as legislation restricting emissions. Tables are given for industrial and metropolitan emission inventories, soiling index, steel plate corrosion, and particle size distribution. Climatology, topography, and meteorolcgical parameters are discussed.

6631 APTIC NUMBER 16560

Jacquemain, P., F. Remy and M. C. Remy-Billon
ATMOSPHERIC POLLUTION IN BESANCON DURING THE YEAR 1967. (La pollution atmospherique a Besancon durant l'annee 1967). Text in French. Ann. Sci. Univ. Besancon, Chim (Besancon), 3(5), 9p., 1968. 3 refs.

The sulfur dioxide content and the smoke-particle-content of the peripheral districts of Besancon were measured, as well as the amount of dust settling on the city as depending on the time of the day. Sulfur dioxide- and smoke- concentrations in air were determined with the S.F. unit. Six 'S.F. stations' were installed at sites distributed over the Besancon area as shown on a map, at a height of 7 meters above ground. These stations read every day, except Saturday and Sunday, between 9 and 10 o'clock, so that the Monday's results give the mean of two days corresponding to the weekend. Station 1 has been operating since March 1966. So that its reading can be compared with those of 1967. Site 6 is 30 m away from railroad tracks and close to the industrial area. The results of SO2- and smoke-concentration measurements by the S.F. stations are given in the form of daily means, biweekly means, and monthly means. The highest daily means of both were about 200 to 300 mg/cu m; the lowest of both, close to 30 mg/cu m, except for greater than 60 mg/cu m at site 5. Biweekly means show higher SO2-concentrations at the three peripheral sites, especially site 5. At city center, the SO2- and smoke-concentrations are higher on the weekdays than of the weekend days. The 1967 results confirm those of 1966. Monthly means show that the SO2- and smoke-concentrations are very much higher in winter than in summer and that in the summer, they are lower at the center city than in the peripheral districts. Results correlate the monthly means of SO2- and smoke-concentrations, rain, in mm, relative humidity, in %, temperature, in (25-t) C, and frequencies of west and north winds, in days/month for correlation of SO2- and smoke-concentrations with meteorological data. Temperature is most directly related to both. Additional measurements were made by two continuously recording smoke samplers.

6632 APTIC NUMBER 16440

Kelenffy, Szilveszter and Jozsef Horik
SOME RESULTS OF THE INVESTIGATION OF AIR POLLUTION CAUSED BY ROAD TRAFFIC. (A kozlekedes okozta legszennyezodes vizsgalatanak nehany eredmenye). Text in Hungarian. Idojaras (Budapest), no. 4:227-231, 1967. 7 refs.

The dust producing effect of road traffic in Hungary was investigated. In addition the concentrations of carbon monoxide, 3,4-benzopyrene, and hydrocarbons were also measured near filling stations. In dry weather, an airborne dust content of 7.0-8.8 mg/cu m on macadamized roads and 3.5-5.2 mg/cu m on concrete roads was found. In rainy weather, the amount of dust was reduced to 2.1-3.4 mg/cu m. On roads with a dust free covering, under average traffic conditions, the dust content was 15,000-20,000 particles/l of air. In urban regions, the average number of particles was 100,000/l of air. Thus, the dust pollution

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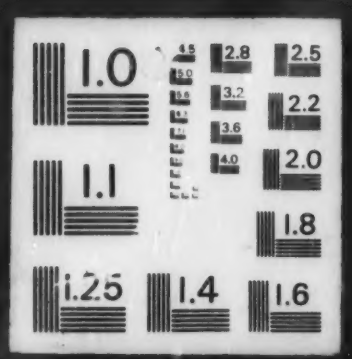

caused by road traffic was of the order of 1 mg/cu m of air. Vehicles followed by a plume of smoke were frequently seen. In the wake of a strongly smoking tractor, 1-1.5 million particles/l were found. In the busiest parts of Budapest, the average concentration of CO amounted to 20 mg/cu m. The concentration of carbon dioxide ranged from 0.03-4.00% of the total value, with an average of 2% of the volume. The tar content of the street dust, collected at busy points, was 3%, and the content of 3.4-benzopyrene equalled 9 micrograms per 1 gram of dust. (Author abstract modified)

6633 APTIC NUMBER 16008

Kelley, John J. Jr.
AN ANALYSIS OF CARBON DIOXIDE IN THE ARCTIC ATMOSPHERE NEAR BARROW, ALASKA 1961 TO 1967. (FINAL REPORT). Washington Univ., Seattle, Dept. of Atmospheric Sciences. ONR Contract N00014-67-A-0103-0007, NR 307-252, 172p., April 1969. 4 refs.
CFSTI: Ad 690557

The results of the measurements of carbon dioxide in the atmosphere at Barrow, Alaska are presented. Reference gas comparison data are tabulated, and methods of calculations are discussed. The average daily concentrations of atmospheric carbon dioxide are tabulated for the period July 10, 1961 to September 15, 1967. The diurnal variations of carbon dioxide during this period are also presented. (Author abstract)

6634 APTIC NUMBER 16565

Kharitonova, S. S.
DUSTINESS OF AIR DURING DUST STORMS ON THE MANGYSHLAK PENINSULA. (Zapylennost', vozdukha vo vremya pyl'nykh bur' poluostrove Mangyshlak). Text in Russian. Meteorol. i Gidrol., no. 5:87-88, May 1969. 4 refs.

The dustiness of air during dust storms on the Mangyshlak Peninsula was studied during 1964-68, when 220 dust storms lasting from several minutes to 18 hours were observed. The samples of air for analysis were taken at heights of 3, 10, and 20 m above the ground. During the dust measurements, the atmospheric temperature, humidity, and wind conditions were examined. Analysis of the results showed that dust storms are of local character, originating at wind speeds higher than 6-7 m/sec and independant of its direction. The fraction of dust particles with diameters of 0.01-0.25 micron predominated. The highest dust concentration obtained during a storm was 245 mg/cu m, 3 m above the ground. The highest average dustiness was observed in summer (40 mg/cu m). The most rapid decrease of dustiness with the height above the ground was observed between 3-10 m.

6635 APTIC NUMBER 16274

Lagutin, Ye. I.
NEW DATA ON THE CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATIONS IN NORTHERN TIEN SHAN. (Novyye dannyye o khimicheskom sostave atmosfernykh osadkov severnogo Tyan'-Shanya). Text in Russian. Doklady Akad. Nauk SSSR, 173(6):1426-1429, 1967. 3 refs.

The value of measurements of the chemical composition of atmospheric precipitations to studies of the metamorphosis of ground water under the influence of many natural factors as well as of that of air in the vicinity of modern industrial cities is stressed. A Table of the chemical composition of 19 samples of snow and one of rain is given, collected on stated days at stated locations in the Northern Tien Shan region lying within the confines of the Kirghiz S.S.R. The concentrations of microcomponents in atmospheric precipitations were determined by subjecting their dry residues to spectral analysis. The composition of the samples is given in terms of milligrams per liter of HSiO3 and of the following ions: HCO3(-), SO4(2-), Cl(-), Ca(2+), Mg(2+), Na(+), and K(+), as well as in the form of a 'chemical composition formula'. The total ion concentration, in milligrams per liter, and the hydrogen ion concentration, expressed in terms of pH value, are also given. Six samples were collected on March 4, 1965 at 6 elevations above sea level between 1000 and 3500 meters in 500-meter steps on the northern slope of the Kirghiz range bordering the Chuysk basin in the south. Five samples were collected at two-week intervals between Sept. 1 and Oct. 30, 1957, on the eastern shore of the Issyk-Kol lake in the Kokbel creek valley of the Dzhergalan river basin.

6636 APTIC NUMBER 15574

Lahmann, Erdwin and Karl-Ernst Prescher
CARBON DIOXIDE CONCENTRATIONS IN A HEAVILY TRAVELLED STREET. (Kohlendioxid-Konzentrationen in der Luft einer verkehrsreichen Strasse). Text in German. Bundesgesundheitsblatt (Berlin), no. 14:204-205, 1968. 8 refs.

The carbon dioxide concentration was measured on a busy street in Berlin 0.75, 1.5, 3, 12, and 24 m above the ground using an infrared analyzer. Half-hourly averages were calculated. All concentrations measured over a period of 2 months were below 500 ppm; a concentration of 400 ppm was rarely exceeded. The highest average CO2 concentration was measured at a height of 1.5 m, although there is only a minor difference between measurements taken here and those taken at 0.75 m. Above 1.5 m, the mean CO2 content dropped to 318 ppm at 24 m. The diurnal variation of the average CO2 concentration shows one maximum in the morning and another one in the afternoon, which occurs two hours after the maximum of the CO content. The correlation coefficient for the CO2 concentration and the simultaneously measure CO concentration was 0.66 (between 6 a.m. and 10 p.m. at 75 m). Thus, it was concluded that there is no correlation between the two pollutants. However, a correlation was seen between CO2 levels and traffic density because CO2 concentration maxima agreed well with traffic peaks.

6637 APTIC NUMBER 16505

Marzot, G.
AIR POLLUTION IN THE CITY OF BOLOGNA. BEHAVIOR OF SULFUR DIOXIDE.

(Sull'inquinamento atmosferico della citta' di Bologna. Comportamento dell'anidride solforosa). Text in Italian. Riv. Ital. Igiene (Pisa), 28(1/2):24-30, Jan.-April 1968. 11 refs.

A continuous study of sulfur dioxide behavior was conducted from November 20, 1967, to April 10, 1968, judged to be the period during which air pollution was aggravated by the waste products of home heating. Quantitative measurements of the variations in SO2 content were made with a Thomas Autometer, which makes use of a sulfuric acid electrolyte. Although other soluble gases, such as HCl, HF, and NH3 also contribute to the reading, the SO2 is the principal component. The average monthly readings were highest during December (0.31), January (0.32), and February (0.28 ppm) and lowest in April (0.09). Over the past 12 years, the average SO2 concentrations have been increasing, and this represents not only an increase in maximum values but in minimum values as well. SO2 content is low during the night hours, increasing to a peak at 8-11 a.m., then decreasing to a minimum at 2-5 p.m. It moves upward to a second, lower peak between 5 and 8 p.m. The two main causes are obviously the use of home heating fuels and motor traffic, the latter being most intense 8-10 a.m. and 6-8 p.m. A breakdown according to days of the week shows constant average values for 5 days, but low values for Tuesday and Sunday. No adequate explanation is given for the low Tuesday values.

6638 APTIC NUMBER 16336

Schaad, R. and A. Gilgen
BENZO(3-4)PYRENE IN THE DUST SEDIMENT OF ZURICH, BADEN AND KLOTENER RIED. (3,4-Benzpyren im Staubsediment von Zuerich, Baden, und Klotener Ried). Text in German. Z. Praeventivmed., 14(5):299-300, Sept.-Oct. 1969. 9 refs.

To determine the benzo(3-4)pyrene content of the dust and the amount of benzo(3-4)pyrene in the human environment dust was sampled with Bergerhoff units. The samplers were established at 15 stations in Zurich, at 5 in Baden, and at one in Kloten. Each station contained three units. The water insoluble fraction of the monthly dust sediment was separated; the benzo(3-4)pyrene was extracted with cyclohexan and analyzed with a spectrometer. The benzo(3-4)pyrene content of the dust in the city of Zurich was more than twice as high as the dust sedimented in rural areas. The concentration was much lower in Baden than in Zurich, but higher than in the rural area. The sedimented benzo(3-4)pyrene quantity in Zurich in summer was two and one half times larger than in the rural area; in winter, five times larger. It was twice as high in Baden than in the rural area. The benzo(3-4)pyrene maxima can be clearly traced to the motor vehicles in summer and to domestic heating in winter.

6639 APTIC NUMBER 16576

Yamate, Noboru, Tosiro Matsumura, and Masaharu Tonomura
LEAD CONTAMINATION OF AIR ON STREET IN ELEVEN MAJOR CITIES IN JAPAN. (Wagakuni 11 toshi no gairo taiki no namari osen ni tsuite). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), no. 85:158-160, 1967. 4 refs.

Lead concentrations in the atmosphere were determined at crossings and road sites in eleven major cities. The lead compounds were collected with a glass fiber filter and analyzed polarographically. The lead concentrations in the daytime were between 0.78 and 11.17 micrograms/cu m. The lead concentration at Route 20 in Tokyo was the highest; and the lowest was found at Sasashima in Nagoya and at Yayoikan in Yokkaichi. The lead concentrations in the atmosphere at crossings and road sites were influenced by traffic density, traffic stagnation, road condition, meteorological and geographical conditions. (Author abstract modified)

6640 APTIC NUMBER 14556

Yamato, M.
SUMMARY OF AIR POLLUTANTS LEVELS IN THREE STATIONS, TOKYO, 1966. (Tokyo-to nai San-chiten no Taikiosen-no Sokutei Kekka no Gaiyo, Jan.-Dec., 1966.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6(4):54-78, Oct. 1968.

In order to assess the influence of automobile exhaust gas upon air pollution, three stations have been established in Tokyo City for measurement of air pollutants. These stations are located in the business center (district A), a chemical industry (district B), and a highway intersection (district C). Hydrogen sulfide, nitrogen oxides, CO, suspended dust, total oxidized substances, amount of daily traffic, etc. were measured and recorded automatically. The results were studied with respect to monthly change during the year, hourly change during the day, daily change during the week, and concentration and distribution of pollutants. Correlation between the amount of pollutants and the amount of traffic has also been studied. Pollution due to exhausted gas seems to be increasing yearly. District A showed the highest concentration of H2S; the yearly average was 8.1 ppm. District C showed the lowest (4.3 ppm). Each district showed highest concentrations during the day. Carbon monoxide was lowest at 4:00 am in each district and reached its peak at 10:00 am, remaining high until 4-5:00 pm. A significant correlation was observed between CO concentration and the amount of traffic. District C showed more than 10 ppm during the day and even rose to 60 ppm momentarily. Nitrogen oxides were 2-4 times higher in district C as compared with the A and B districts. Suspended dust has been decreasing in all the districts, possibly due to the improvement of filtering systems and road conditions.

6641 APTIC NUMBER 14452

Beilke, Siegfried and Hans-Walter Georgii
INVESTIGATION ON THE INCORPORATION OF SULFUR-DICXIDE INTO FOG- AND RAIN-DROPLETS. Tellus (Uppsala), 20(3):435-442, 1968. 9 refs.

The results of an experimental investigation on washout and rainout of SO2 by raindrops and fog droplets of given size-distribution are presented. The laboratory studies were supplemented by model calculations on the sulfate concentration in rainwater caused by washout and rainout of SO2 and sulfate aerosols. It is shown under which circumstances the rainout mechanism becomes predominant for the chemical composition of rainwater on the ground. (Author abstract modified)

6642 APTIC NUMBER 16003

Berlyand, M. Ye.
BASIC PROBLEMS OF ATMOSPHERIC DIFFUSION AND AIR POLLUTION. (Osnovnyye problemy atmosfernoy diffuzii i zagryazneniya vozdukha). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 218:295-308, 1967. 60 refs.

Studies on turbulent diffusion and atmospheric turbulence are reviewed on the basis of 60 Soviet references published during the years 1937-1966. The Main Geophysical Observatory is engaged in developing the USSR's first automatic SO2 monitor. Special teams have been established to examine air pollution in ten major cities in the Ukraine, Urals, and Siberia.

6643 APTIC NUMBER 16269

Briggs, G. A.
MATHEMATICAL ANALYSIS OF CHIMNEY PLUME RISE AND DISPERSION. OPTIMUM FORMULAS FOR BUOYANT PLUME RISE. Phil. Trans. Roy. Soc. London, Ser. A, vol. 265:197-203, 1969. 21 refs.

Plume rise formulas were compared in light of more recent data. A formula for near-neutral conditions was needed, particularly for determining the maximum ground concentration of a pollutant at the critical wind speed. For each source, plume rise at one or several fixed distances was plotted against wind speed on logarithmic coordinates. There was a great deal of scatter in all of the plots, but in almost every case, the points fitted well to a simple reciprocal wind speed law. The average product of plume rise and wind speed at the greatest possible distance downwind for each source was calculated from comparison with other formulas. For each formula tested, the ratios of the calculated to observed values of plume rise times wind speed were computed. The median value of this ratio and average percentage deviation from the median were determined for all data. Of the established formulas, the Stuemke, and the Moses and Carson ones work best. The two-thirds law gives better agreement that any of the empirical formulas. Still b[illegible]esults were obtained with a modified two-thirds law in w[illegible]e plume is assumed to stop rising at 10 stack heights downw[illegible] slightly higher rise was found in unstable than in neal[illegible]ral conditions, but there was no significant change in the value of average plume rise times wind speed from the value of neutral conditions. The optimum formulas for the near-neutral case were suggested for use. There is little data for stable conditions. The average final height is just a little higher than what is predicted by the model that leads to the two-thirds law. No modification of the single stack formula was recommended. For buoyant plume rise under stable conditions, the formula given by Morton, Taylor, and Turner gives excellent agreement with a large range of data.

6644 APTIC NUMBER 16390

Bullrich, K., R. Eiden, G. Eschelbach, K. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
ELLIPTICAL POLARIZATION OF THE SKYLIGHT AND THE ATMOSPHERIC AEROSOL. In: Research on Atmospheric Optical Radiation Transmission. Dec. 1, 1967 - Nov. 30, 1968. (Final Report.) Johannes Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie, CAR Contract F 61052 67 C 0046, AFCRL-69-0266, p. 1-4, 108-111, Jan. 1969. 38 refs.

Elliptical polarization of skylight was measured in the heavily polluted Rhine-Mainz area. The ellipticity tan Beta was plotted as a function of the azimuth angle alpha, with tan Beta defined as the ratio of the greater to the smaller axis of the ellipse which is traced by the electrical vector. Measurements taken along various horizontal circles of constant elevation at a constant wavelength showed the same trend. Ellipticity was zero at alpha equals 0 deg and alpha equals 180 deg. A maximum was located between 40 and 90 deg as tan Beta equals 0.1 or less, depending on the turbidity and elevation of the observation circle. From this maximum, ellipticity decreased continuously in both directions. In cases of great turbidity when the visual range was less than 5 km, measurements showed no ellipticity. The production of elliptically polarized light is assumed to result from higher order scattering processes and the absorptive properties of atmospheric aerosols.

6645 APTIC NUMBER 16284

Bullrich, K., R. Eiden, G. Eschelbach, K. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
MEASUREMENT OF LIGHT ABSORPTION BY AEROSOL PARTICLES WITH AN INTEGRATING SPHERE. In: Research on Atmospheric Optical Radiation Transmission. Dec. 1, 1967 - Nov. 30, 1968. (Final Report.) Johannes-Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie, CAR Contract F 67 C 0046, AFRCL-69-0266, p. 5-10, 108-11, Jan. 1969. 38 refs.

The spectral extinction of light passing through the atmosphere is a function of the concentration and the size distribution of suspended aerosol particles, as well as their complex index of refraction. The particle size and the complex index of refraction depend on the relative humidity of the ambient air. The influence of this on the density and the real part of the complex index was already quantitatively determined. In the present investigation, the imaginary part of the complex index of refraction that



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represents energy loss by absorption was determined. The absorptivity of aerosol samples was investigated in intervals of 70 to 80 nm in the wavelength part of 400 nm with duplex band-pass interference filters. Since aerosol particles not only absorb light but reflect and scatter it, an integrating sphere was used so that radiant energy could be considered. An equation was derived for computing the imaginary part of the refractive index from measurements of reflected energy, traversed plus reflected energy, incident energy, and supplemental measurements of relative humidity. The imaginary part was found to be 0.03 at Lambda equals 0.413 micron and 0.08 at Lambda equals 0.9 micron.

6646 APTIC NUMBER 16392

Bullrich, K., H. Eiden, G. Eschelbach, H. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
PRELIMINARY RESULTS OF COMPUTATIONS OF THE AEROSOL SCATTERING FUNCTIONS OBTAINED FROM POPULATIONS FOLLOWING POWER LAW PARTICLE SIZE DISTRIBUTION. In: Research on Atmospheric Optical Radiation Transmission. Dec. 1, 1967 - Nov. 30, 1968. (Final Report.) Johannes Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie, OAR Contract F 61052 67 C 0046, AFCRL-69-0266, p. 30-35, 108-111, Jan. 1969. 38 refs.

Computations of aerosol scattering functions are based on various refractive indices for the scattering functions of populations of spheres whose particle size distributions follow power laws. Boundary radii chosen for power law distributions were 0.04 and 10 micron. Measurements made at the wavelength of light Lambda equals 0.4 micron show the influence of both the real and the imaginary part of the complex index of refraction on the scattering function. The intensity of the scattered light increases with increasing real part and decreasing imaginary part of the index. The angular dependence of the scattering function increases with decreasing real part and increasing imaginary part of the index. Changes in the relative humidity of the ambient air also influence scattering functions. Estimations of the scattering function for Lambda equals 1.6 micron at different humidities show that at scattering angles less than 15 deg, the forward scattering increases with increasing relative humidity; at scattering angles greater than 15 deg, the scattering function decreases with increasing relative humidity. At an angle of 30 deg, the reduced scattering function for power law distribution is almostt idependent of the refractive index, and the scattering coefficient is almost equal to the extinction coefficient.

6647 APTIC NUMBER 16406

Carnuth, W.
RELATIONSHIP OF AEROSOL PARTICLE SPECTRUM TO METEOROLOGICAL CONDITIONS. (Zur Abhaengigkeit des Aerosolpartikelspektrums von meteorologischen Vorgaengen und Zustaenden). Text in German. Arch. Meteorol. Geophys. Bioklimatol. Ser. A (Vienna), 16(4):321-343, 1967. 30 refs.

Continuous measurements of aerosol particle spectrum were conducted over a period of two years (from March 1964 to Feb. 1966) in the Alpine valley of Garmisch with a three stage cascade impactor. The resulting data were used to determine the effects of meteorological conditions and of the wash out effect on the aerosol particle spectrum. The particle size distribution was determined by using the empirical distribution law dN equals c.D exp(-nu)dD to three measured concentrations of three particle sizes. In this law, N is the particle concentration; D, the particle size; c, the particle concentrations for D equals 1; and nu, an empirical exponent. The monthly averages of c showed no pronounced seasonal variation. A correlation with the amount of precipitation was weakly discernible, which meant that it alone is not enough to characterize the influence of the weather conditions on the suspended particle content of the air. The influence of rain, snow, shower, and steady rain was determined by observing the variables log(c/c0)/h and (nu-nu0)/h, where the subscript 0 denotes the quantity before precipitation and h is the precipitation in mm. Shower had little effect, while steady rain decreased c and increased nu. Snow was more effective than rain, but its quantitative effect was difficult to determine. Local wind had a marked influence.

6648 APTIC NUMBER 16131

Charlson, R. J. and N. J. Pilat
CLIMATE: THE INFLUENCE OF AEROSOLS. J. Appl. Meteorol., 8(6):1001-1002, Dec. 1969. 4 refs.

A method is presented for estimating the relative effect of light scattering and absorption of particles on the climate. The atmosphere is considered to be a flat, nearly transparent, thin, uniform scattering and absorbing layer above the earth's surface. The incoming radiation from the sun in the zenith is presumed to be affected by aerosols while outgoing radiation is not. The amount of energy absorbed (W) in unit time by the earth-atmosphere system is the sum of the absorption at the surface and by the atmosphere. It is shown that the a backscattering, non-absorbing aerosol would clearly decrease W, thereby cooling the earth-atmosphere system. The effects of the extinction coefficient of absorption, however, are two-fold. Since the fractional absorption of the surface is less than 1, any increase in the extinction coefficient of absorption results in an increase in W for a given extinction coefficient of backscatter. The location of heating is removed from the surface to higher in the atmosphere, resulting in increased static stability as well as increased W. The effect of a secular increase in aerosols might be an increase or a decrease in W, depending on the relative magnitudes of the extinction coefficients due to absorption and backscatter and the absolute magnitude of the extinction coefficient due to absorption. It is possible to estimate relative values for the extinction coefficients due to absorption and backscatter in order to determine which dominates. The net climatological effect of industrial smoke, which contains light-absorbing substances such as carbon and iron oxide could well be to heat, not cool, the earth.

6649 APTIC NUMBER 16093

Dronia, Horst
THE INFLUENCE OF CITIES ON THE WORLDWIDE TEMPERATURE TREND.

Meteorologische Abhandl., 7A(4):1-65, 1967. 38 refs. Translated from German. 84p.

Long-term temperature trends for large areas of the world were determined by excluding the warming influence of growing cities. The first method used was the comparison of non-influenced areas and city areas, computed by the differences of those stations. Sixty-seven pairs, spread over the world, resulted in an average city influence of +0.24 C for a 40 year period (1901/10 to 1941/50). Previous to this period, and at the beginning of the period, the difference was higher; thus, the amount of change for 1871/80 to 1951/60 was +0.7 C. If the magnitude of world-wide warming is reduced proportionately to the share of cities in the long term series, a slight cooling of -0.2 C remains. The second method divided the global temperature trend into 2 individual series which comprised stations situated in cities and in the open country. The temperature trend was the same as the result from the growing cities. A computation of the world wide temperature trend since 1871/80 from non-influenced stations and some reduced city stations gave the same temperature curve as the other two methods. According to data from the temperature curve, the temperature, after a short rise, fell 0.2 C since 1871/80. This amount of 0.8 C below the present value which is accepted as valid. In this way, the world-wide warming influence diminished in two or three decades to a value not higher than +0.25 C. It was concluded that even if the first ten years (with the strongest cooling and the smallest number of stations) are excluded, the present temperature is the same as it was 80 years ago. (Author summary modified)

6650 APTIC NUMBER 15719

AIR POLLUTION COOLING OFF EARTH, WILL CHANGE CLIMATE IF NOT CHECKED. Eng. Mining J., 170(2):120 and 122, Feb. 1969.

The climate of the world has shown a cooling trend since 1940 as a result of increased smoke and dust pollution and major climatic changes will result if the situation is not checked. Although increased CO2 tends to raise atmospheric temperatures, turbitity, which has been increasing, tends to lower atmospheric temperatures. Dust and smoke from rural and urban areas has been increasing at a rapid rate. This is a brief review of a paper presented by Reid A. Bryson of the University of Wisconsin at the annual meeting of the American Association for the Advancement of Science.

6651 APTIC NUMBER 15773

Fay, James A., Marcel Escudier, and David P. Hoult
A CORRELATION OF FIELD OBSERVATIONS OF PLUME RISE. Massachusetts Inst. of Tech., Cambridge, Fluid Mechanics Lab., Grant AP 00678-01, Pub-69-4, 29p., April 1969. 11 refs.
CFSTI: AD 690895

Data from 137 sets of plume observations, comprising nearly 1500 data points, were correlated with two simple formulae. These formulae, one for the buoyancy-dominated rise region and the other for the stratification-dominated leveled-off region of a plume, represent an approximate form of Hoult's entrainment theory for the case of uniform atmospheric stratification and zero wind shear. The observed plumes had source strengths from 0.4 to 111 MW and were emitted from stacks of heights between 21 and 183 m. The two formulae correlate the date equally well over all values of the stack exit and meteorological parameters, provided only that the bulk mean velocity of the stack gases exceeds the mean wind speed by at least 20%. The ratio of observed to calculated plume rise is found to be distributed log normally about the mean value. The median rise at large distances downstream was found to differ insignificantly from that given by the effective stack height formula recently recommended for large buoyant plumes. Based on the correlation, two formulae are recommended for computing median plume rise at all distances downstream of the stack. The formulae include an estimate of the expected uncertainty in the predicted rise. (Author abstract modified)

6652 APTIC NUMBER 16114

Faedler, Franz
INVESTIGATION ON THE DIFFUSION OF ATMOSPHERIC PROPERTIES AND CONTAMINANTS. PART I. THE METEOROLOGICAL PARAMETER IN THE TURBULENT DIFFUSION EQUATION. (Untersuchungen ueber die Ausbreitung von Atmosphaerischen Eigenschaften und Luftbeimengungen. Teil I. Die meteorologischen Parameter in der turbulenten Diffusionsgleichung). Text in German. Beitr. Physik Atmosphaere, 42:143-173, Mar. 1969. 43 refs.

The diffusion of atmospheric properties and contaminants is determined by the horizontal and vertical dispersion parameters sigma y and sigma z. They assume different values according to the temperature and wind stratification. Studies were undertaken to determine whether the dispersion parameters could be computed from measurements of the mean vertical temperature gradient and the wind speed using parameterizations of the characteristic turbulent velocities. This procedure succeeded for the parameter sigma z, giving values which are comparable to those calculated by other methods. The method is not successful for the parameter sigma y because the knowledge of the mean square horizontal velocity fluctuation is still insufficient.

6653 APTIC NUMBER 16333

Faedler, Franz
INVESTIGATIONS ON THE DIFFUSION OF ATMOSPHERIC PROPERTIES AND CONTAMINANTS. PART II. THE STABILITY CLASSES AFTER F. PASQUILL AND THE MEAN DISPERSION CONDITIONS AT THE RESEARCH REACTOR STATION MUNICH. (Untersuchungen ueber die Ausbreitung von atmosphaerischen Eigenschaften und Luftbeimengungen. Teil II. Die Ausbreitungsklassen nach F. Pasquill und die mittleren Ausbreitungsbedingungen beim Forschungsreaktor Muenchen). Text in German. Beit. Physik Atmosphaere, 42(4):251-286, 1969. 24 refs.

Pasquill's characterization of the turbulent state of the surface layer is frequently used. His scheme is considered on the basis of the balance equation for the turbulent energy. A similar schematization can be achieved directly with the diffusion

coefficient for heat. With the aid of the stability classes of Pasquill, the diffusion conditions at the meteorological station of the research reactor Munich were studied for the three-year period of 1962 to 1964. With the meteorolcgical data, the relative concentrations were calculated for each hour for the measurement grid. An emission discharge height of 50 m was inserted into the calculation. The concentrations obtained for the various gridpoints are shown in maps. Lines drawn through the points of equal cumulative frequency of the relative concentration show the marked influence of wind direction. The different wind speeds and the different stability conditions in the atmosphere are of secondary importance. For further characterization of the diffusion conditions, the frequency of excess threshold concentrations was studied. They were most frequently exceeded along the axis of most frequent wind directions. As the diffusion conditions for Munich show, industrial complexes are best limited to the north or the south of the city, since the prevailing winds come from the east as much as from the west, but rarely from the south or north. This means that no emissions can be carried toward the center of the city.

6654 APTIC NUMBER 16320

Frost, Justin
EARTH, AIR, WATER. Environment, 11(6):14-33, July-Aug. 1969. 42 refs.

The world-wide pattern of pesticide distribution is discussed and the dispersal mechanism considered. It is now clear that pesticide residues are being disseminated in both the Atlantic and Pacific Oceans all the way from the Arctic to the Antarctic, with subsequent contamination of the food chains leading to the higher animals. While migratory birds undoubtedly assist in pesticide dispersal, their role does not fully explain the contamination of Antarctica. If rivers were the principle source of ocean contamination, animals near river outflows should show higher pesticide concentrations than those off other parts of a coast, but this is not always the case. Moreover, the average concentration of pesticides in rainwater is equivalent to and often higher than the highest concentrations found in river water. Similarly, ocean currents are not the general mechanism of ocean contamination; they can transport pesticides elsewhere in the world but not to the Antarctic. In view of the ability of pesticides to vaporize in the atmosphere, where they are picked up by dust particles, the atmosphere is the most likely route of dispersal. The major features of this dispersal from the time pesticides are released to the atmosphere until they accumulate in marine animals are reviewed.

6655 APTIC NUMBER 16554

Fukuoka, Saburo and Toshio Odaira
AIR POLLUTANTS AND METEOROLOGICAL ASPECTS AT THE SMOG ALERT 'SSUANCE IN TOKYO. (Tokyoto ni okeru sumoggu chuiho hatsureiji no osenshitsu modo to kishyo jyoken). Text in Japanese. Kogai to Taisaku, (J. Pollution Control), 2(11):757-766, Dec. 1966.

Ten smog alerts issued in Tokyo during the past four years are analyzed in meteorological terms. Two levels of pollution status prescribed in the issuance standard are smog caution, which is issued when sulfur dioxide concentrations at two observation centers simultaneously exceed 0.2 ppm for two to three hours and smog alert, which is issued when SO2 concentrations measured at the main observation center exceed 0.5 ppm. In all cases, the smog alert was given between 9 a.m. and 11 a.m. This is probably attributable to the fact that high SO2 concentrations are emitted by industry in the first three hours of the working day. The duration of the alarms averaged 6 hours and 40 minutes. This means the high concentrations of SO2 lasted for about 10 hours. There were exceptional cases which showed a significant relationship between weather conditions and SO2 concentrations. The peak of SO2 pollution was reached between 4 and 5 p.m. and followed by a slow descent. Analysis of wind and temperature data reveals that southern winds are closely related to the occurrence of high SO2 concentration and their diffusion, especially south-southeast winds. It is conjectured that some of gaseous pollutants originating in the Tokyo-Yokohama industrial area are carried directly to the Tokyo sky, while the remainder are first carried aloft over Tokyo Bay and then blown back by sea breezes.

6656 APTIC NUMBER 15978

Inoue, Eiichi
SIMILITUDE OF TURBULENT DIFFUSION PHENOMENA IN THE THERMALLY STRATIFIED SURFACE-LAYER OF THE ATMOSPHERE. Proc. Japan Nat. Congr. Appl. Mech., 9th, Ueno Park, Tokyo, 1959: 283-286.

Though turbulent diffusion of stack smoke in the atmospheric surface layer is an important air-pollution problem, existing models for studying the behavior of smoke in wind tunnels do not consider the relative similarity of smoke diffusion to stack height. Moreover, the behavior of a continuously emitted smoke plume is often considered as a problem of fixed-source type diffusion. Equations are developed for simulating the similarity law of diffusion phenomena in wind tunnel experiments. They describe vertical diffusion depth, spatial vertical diffusion depth, vertical distribution of wind velocity under andiabetic, or slightly nonadiabetic, conditions, and the ratio of wind velocity and temperature differences. The possibility of applying the vertical diffusion equations to cross-wind diffusion phenomena is suggested.

6657 APTIC NUMBER 16332

Israel, Hans
THE GENERATION OF ELECTROSTATIC CHARGE IN THE ATMOSPHERE. (Elektrostatische Ladungsbildungen im atmosphaerischen Bereich). Text in German. Naturw. Rundschau, 22(8):153-160, April 1969. 23 refs.

The generation of electrostatic charge in a pure gaseous atmosphere, in an aerosol infested atmosphere, and finally in precipitation and thunderstorms is reviewed. In the ideal case of a pure gaseous atmosphere, positive and negative charges are present in each volume element in equal numbers. Electrostatic charges develop when the state of equilibrium among the ions is

destroyed, as by an external field. In an aerosol laden atmosphere, the various suspended particles (dust, soot, droplets, etc.) participate in generating the charge. They receive charges from small ions which settle on them, thereby depriving the primary charge carriers of their mobility. The conductivity of the air decreases. This again changes the space charge. The presence of the aerosols moreover, changes decisively the duration of all processes based on the ion movement. With precipitation, the falling droplets charge up to the polarity of the oncoming ions. This charge separation increases the field strength. The polarity is determined by the external field direction. If the droplets are larger than 5 mm in diameter, they are deformed and torn through the fall. The fine droplets assume negative charge; the coarse droplets, positive charge. Separation by various fall speeds produces an electric field with vertically upward directed field vector. For the charge formation during thunderstorms, the various familiar theories (ice-ice impact, influence theory, surface changes, phase change) are outlined. A thunderstorm creates a potential difference between the earth and the ionosphere of 25 GkV and by that the above mentioned external electric field.

6658 APTIC NUMBER 16534

Itoo, Kyoji
SOME METEOROLOGICAL PROBLEMS CONCERNING TO PUBLIC NUISANCE PROTECTION ON AIR POLLUTION METEOROLOGY. (Kogai taisakusen kara toraeta kishogakuteki shokosatsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(2):74-79, June 15, 1965.

Stack meteorology, which deals with almost the same field as general meteorology, has occupied an important position in air pollution control. In reality, however, neither field meets the current needs of air pollution control programs, with differences between the two approaches requiring the establishment of a third field, air pollution meteorology. Stack meteorology is primarily concerned with the analysis of the shape of a smoke plume and with formulas for smoke diffusion and chimney heights required for effective diffusion. Consequently, meteorological conditions which have apparent effects on the smoke shape occupy a large part of stack meteorology. While a smog source obviously originates pollutants, it does not always produce the same results. This means that smoke may turn to smog one day but not on another day, even under similar operating conditions. This is why air pollution meteorology is needed. Meteorological conditions likely to give rise to the smog phenomena are weak winds, temperature inversions, and dense fog. The experience of some plants indicate that a gust of wind can increase SO2 density. This is designated as a gust-of-wind pollution. In general, it accounts not only for wind velocity or direction, but also for the relationship between the height of the pollution source and that of surrounding buildings.

6659 APTIC NUMBER 16513

Ivanov, A. I., G. Sh. Livshits, V. Ye. Pavlov, B. T. Tashenov, and Ya. A. Teyfel'
LIGHT SCATTERING IN THE ATMOSPHERE, PART 2. (Rasseyaniye Sveta v Atmosfere, Chast' 2). Alma Ata, Nauka Press, 1968, 115p. 153 refs. Translated from Russian. National Aeronautics and Space Administration, Washington, D. C., Scientific and Technical Information Div., 122 p., Nov. 1969.
CFSTI, NASA: TT F-553

Results of spectrophotometric studies of the brightness and polarization of the daytime sky are reported, together with observations of the scattering function and other optical parameters of the atmosphere. Direct and indirect approaches to the problem of light scattering in earth's atmosphere are contrasted, and observations are compared with recent theoretical calculations. Methods are proposed for calculating sky brightness and polarization that take into account aerosol microstructure and multiple scattering. These methods give good agreement with the direct measurements of other investigators. Pure absorption in aerosols is considered and, on the basis of the established properties of the aerosol scattering function, a formula is derived that interrelates a number of parameters of the earth's atmosphere. Fundamental difficulties in determining the aerosol spectrum from optical observations of the sky are indicated. (Author abstract modified)

6660 APTIC NUMBER 15980

Iyutatsau, S. V.
INVESTIGATION OF THE CLOUDINESS FACTOR OF THE ATMOSPHERE IN THE KURSK REGION. (Osobennosti terrasovykh ryadov na rechnykh dolinakh sibiri i dal'nego vostoka). Text in Russian. Izv. Akad. Nauk SSSR, Ser. Geogr., no. 1:95-99, 1969. 5 refs.

Results from a series of actinometric observations, made in 1966 over the course of several days in low-population forest areas of the Kursk Region, are presented. A cloudiness factor was recorded for wavelengths above 625 millimicrons. The presence of water vapor was a much more important factor determining cloudiness than was the presence of aerosols. It is concluded that the cloudiness factor proposed by F. Linke is suitable only for fresh, nontransformed air, but not for conditions near urban or industrial centers. Such studies may be used to help determine the effect of various contributions to the heat balance in the forest-steppe region of the USSR.

6661 APTIC NUMBER 16014

Jackman, Dean Weldon
A STUDY OF METEOROLOGICAL EFFECT ON AIR POLLUTION IN THE SALT LAKE VALLEY. Utah Univ., Salt Lake City, Dept. of Meteorology, Thesis (MS), 1968, 80p. 23 refs.

The effect of wind flow, wind stability, and topographic factors on the diffusion and transport of pollutants was evaluated for the Salt Lake Valley. A climatological study, shown in a wind rose, was first made of annual winds at the Salt Lake City airport. To compare wind conditions under stagnation conditions, a study was then made using only winds during stagnation periods. This study justified the assumption of a mountain-valley wind regime during stagnation and shows that wind velocities and direction can be used

to estimate horizontal transport. To study vertical transport, 1460 radisonde ascents were made in 11 months, with 645 ascents showing ground or low-level concentrations. The magnitude range of inversions was 1 to 34 F, with a monthly average ranging from 3.8 F in April to 103 F in October. The average inversion depth was 850 ft. To determine the frequency and seasonal distribution of severe winter air pollution episodes, month-long visibility curves were obtained for winter months. They show that visibility begins to lower as stagnation sets in and becomes restricted after about 48 hours. The slope of the curve drops at the average rate of 10 miles per day. After 48 hours the curve flattens considerably, the slope decreasing at a rate of one mile visibility per day. This rate continues for five days until the visibility is less than one mile in smoke. After seven days, enough moisture has been added to the air by combustion processes, and trapped by continuous inversion conditions, to produce fog. This combination of fog and pollutants is particularly dangerous. A simple diffusion model is presented that gives combined wind speed, mixing depths, and stability, the most important parameters of air pollution potential. It shows good correlation with visibility, the only available measure of pollution in the Salt Lake Valley. If emission data were available, the model could be used as a function of wind direction to give apparent source strength and concentrations.

6662 APTIC NUMBER 16618

Kelley, John J., Jr.
CARBON DIOXIDE AND OZONE STUDIES IN THE ARCTIC ATMOSPHERE. In: Arctic Drifting Stations: A report on Activities Supported by the Office of Naval Research. J. E. Sater (coordinator), Washington, D. C., Arctic Inst. of North America, 1968, p. 155-166. 27 refs. (Also: Washington Univ., Seattle, Dept. of Atmospheric Sciences, Contract NONR-477(24), TR-38, 1969.)
DDC: AD 685571

Measurements of atmospheric carbon dioxide and surface ozone concentrations at Barrow, Alaska are reported. Continuous carbon dioxide monitoring began in 1961 and continuous ozone monitoring in 1965. Carbon dioxide concentrations are found to increase in the late spring and then to decrease to a summer minimum, which corresponds closely to the maximum vegetation bloom on the tundra. When the tundra surface is frozen, daily CO2 concentrations show strong gradients between the surface and 16-m level. These fluctuations depend on wind speed, temperature, and snow cover. There is much less fluctuation in atmospheric CO2 when the tundra is in bloom. The vegetation bloom period is thought to provide a sink for CO2. During the year, ozone fluctuates at Barrow from less than 1 pphm to more than 7 pphm. Variations in surface ozone concentration show much greater variability during the winter and early spring than in the summer and fall. Large fluctuations in ozone near the ground are nearly always correlated with storm front passages. All increases in ozone correspond to a rise in ambient air temperature, increased wind speed, and decreased atmospheric pressure. Aircraft sampling is suggested to supplement ground-level monitoring data.

6663 APTIC NUMBER 16342

Khrgian, A. Kh.
RECENT INVESTIGATIONS ON ATMOSPHERIC OZONE. (Novoyshiya issledovaniya po atmosfernomu ozonu). Text in Russian. Fiz. Atm. i Okeana (Moscow), 5(4):435-438, 1969.

The Symposium of the International Commission on Atmospheric Ozone, held September 2-7, 1968 at Monte Carlo, Monaco is reviewed. Brief comments are made regarding contributions touching upon the following subjects: a photometric model of the ozone layer; reactions occurring in the dry and moist stratosphere; the role of fast electrons on O3 dissociation; the process of ozone formation; the role of the troposphere as a strong ozone source; the precision and usefulness of the reversal method of ozone study instances of observed secondary reversal; studies of the absorption coefficient of ozone and precision of its determination; diurnal ozone variations in southern latitudes; the role of vertical movement and activation on ozone photochemistry; effects of intrusions of cold ozone-rich air in a thin layer over isentropic surfaces; the distribution of ozone in high-altitude cyclones and anticyclones; the relationship of stratospheric flows to sharp changes in ozone content in lower layers; ozone concentration over the North Atlantic; and photochemical and advective factors affecting ozone redistribution.

6664 APTIC NUMBER 15831

Lea, Duane A.
VERTICAL OZONE DISTRIBUTION IN THE LOWER TROPOSPHERE NEAR AN URBAN POLLUTION COMPLEX. J. Appl. Meteorol., 7(2):252-267, April 1968. 38 refs.

From May to December 1965 and from June 1966 to June 1967, balloon-borne ozonesondes were flown from Point Mugu, California once each week to study ozone in the stratosphere. High ozone amounts were frequently observed over low altitudes. To examine the apparent relationship between ozone fluctuations and local circulation variations, the lower tropospheric portion of each sounding was hand or computer reduced and analyzed for maximum detail. The highest ozone concentration cases presumably associated with the influx of smoggy pollution from the nearby Los Angeles Basin. But even when the arriving air's trajectory was more obscure, distinct ozone maxima were frequently measured in association with stable strata aloft. Urban pollution is thought to be the major source for at least the stronger maxima observed. Subsidence may be a lesser contributing factor. The soundings showed a pronounced tendency for the maximum ozone to occur above the base of the low-level temperature inversion. A possible explanation might involve lifting of the Los Angeles pollutant into the inversion by convection and orography, followed by modification enroute to Point Mugu by differential erosion across the marine boundary layer and by differential advection in mesoscale circulations. From the persistence of observed ozone maxima in the soundings, the semipermanent temperature inversion over coastal southern California appears to be an effective reservoir for atmospheric ozone. It seems likely that the stored ozone can be brought down to the surface by inversion undulations or by penetrative convection so as to contribute to

existing surface pollution. The data obtained suggest that ozone sampling offers promise in deducing local airmass histories and as an indirect indicator of air flow over noninstrumented areas. To the extent that ozone gradients may be characteristic of local airmass boundaries near urban pollution complexes. Ozone measurements might offer feasible means of delineating such local circulation features as land and sea breezes, Santa Ana wind systems, and mesoscale eddies.

6665 APTIC NUMBER 15570

Niemann, Brand Lee
LAGRANGIAN MICROSCALE TURBULENCE AND DIFFUSION IN THE ATMOSPHERE. Utah Univ., Salt Lake City, Dept. of Meteorology, Thesis (MS), June 1968, 27p. 11 refs.

Analysis of the motion of a cluster of fluid particles in the Lagrangian system is fundamental to the understanding of turbulent diffusion in the atmosphere. This paper reports an analysis based on available information about the trajectories of many fluid particles in the atmosphere and on observational tests of Lin's theory of diffusion by continuous movements. Lin's theory is suitable for atmospheric diffusion analysis where the horizontal coefficient of diffusion may be many times larger than that in the vertical. The trajectories of many individual particles diffusing near 500-ft atmospheric level were observed in two experiments. In the first experiment, bubbles were released at 866 feet above the ground; in the second experiment, they were released at 568 feet above the ground. The autocorrelation coefficients of the vector acceleration were computed and the value of the Lagrangian parameter in Lin's one particle theory was found to be 3 and 5 sq cm cu sec for the two experiments. The mean autocorrelation coefficients of the vector relative acceleration were also computed: the value of the Lagrangian parameter in Lin's isotropic diffusion theory is 68 and 28 sq cm cu sec. The horizontal eddy diffusivities of isotropic diffusion range from 400 to 6400 sq cm reciprocal sec. Both the Lagrangian autocorrelation coefficients and energy spectra, which are presented in graphs, were computed for the longitudinal and transversal components of the velocity. When corrected for velocity deviation, the energy spectra were found to increase with decreasing wave frequency and to be approximately proportional to the minus third power of the wave frequency.

6666 APTIC NUMBER 12524

Pilipowskyj, S., J. A. Weinman, B. B. Clemesha, G. S. Kent, & R. W. Wright
INVESTIGATION OF THE STRATOSPHERIC AEROSOL BY INFRARED AND LIDAR TECHNIQUES. J. Geophys. Res., 73(24):7553-7560, Dec. 15, 1968. 19 refs.

Analysis of downward directed infrared irradiances measured in the tropical stratosphere indicated that reasonable limits on the gaseous composition of the atmosphere could not account for the irradiances observed between 14 and 24 km. Additional emitters were therefore assumed to exist at these altitudes. The altitude dependence of the additional emitter compared reasonably well with aerosol profiles derived from lidar backscatter measurements conducted simultaneously in the same region. Mie theory is applied to model aerosol size distributions; the results of such analysis are compared with data obtained at lambda = 0.694 micron and 3 micron less than lambda, less than 100 micron to provide estimates of the size distributions and mass density of the stratospheric aerosol at altitudes of about 18 km. (Author's Abstract) ##

6667 APTIC NUMBER 16324

Podlaha, Miroslav
MODELLING OF ATMOSPHERIC DIFFUSION PROCESSES. (K modelovani procesu atmosfericke difuze). Text in Czech. Energetika (Prague), 19(12):489-492, 1969. 13 refs.

The conditions and assumption necessary for modeling atmospheric phenomena at a reduced scale in a wind tunnel were described by the equation of atmospheric diffusion. Tests showed that in modeling atmospheric phenomena, it was not necessary to strictly adhere to the Reynold's criterion and that it is the Lambda criterion which is decisive for this case. The Lambda criterion is derived from the equation for atmospheric diffusion which takes into account sources of contamination. (Author abstract modified)

6668 APTIC NUMBER 16339

Polster, Gebhard
EXPERIENCES WITH RADIATION-, TEMPERATURE GRADIENT AND WIND MEASUREMENTS AS PARAMETERS OF DIFFUSION CATEGORIES. (Erfahrungen mit Strahlungs-, Temperaturgradient- und Windmessungen als Bestimmungsgroessen der Diffusionskategorien). Text in German. Meteorol. Rdsch., 22(6):170-175, 1969. 16 refs.

The methods used by Pasquill, Turner, and Szepesi to characterize the diffusion categories are briefly outlined. Pasquill bases his diffusion catgeories on the radiation intensity, as does Turner. But he defines the radiation indensity as a function of the altitude of the sun. Szepesi bases his diffusion categories on the temperature gradients. Radiation, temperature gradient, and wind measurements taken by the nuclear installations Juelich are compared with the above systems and correlation factors are calculated. Measurements of the natural radioactivity taken with a step filter in intervals of 3 hours and correlation of the results with the various diffusion categories and the Brookhaven categories yielded relatively low correlation coefficients. This was explained by the influence of high altitude temperature inversions and by insufficient differentiation of the diffusion conditions at pronounced stability. Through radio sounding, the influence of the high-altitude inversion on the diffusion conditions at noon were approximately determined and, with the aid of temperature gradient measurements, the intensity of the surface inversion were taken into account. Better correlation coefficients were obtained. Of the parameters of the diffusion categories, the temperature gradient proved to be the most efficient so that better correlations to the system by Szepesi than to the other systems were found.

6669 APTIC NUMBER 16428

Rasenskiy, I. A.
RELATIONSHIP BETWEEN HOT SULTRY WEATHER AND AIR POLLUTION IN ODESSA. (Svyaz' zharkikh i dushnykh pogod s zagryaznennost'yu vozdukha v Odesse). Text in Russian. Meteorol. Klimatol. i Gidrol., no. 3:148-151, 1968. 8 refs.

The relationship between air pollution and high temperature in the resort city of Odessa is examined on the basis of data collected during the years 1959-1963. Although no definite relationships are established, it is noted that half of the sultry days are accompanied by air pollution (greater than 0.50 mg/cu m). A sultry day is defined as one in which the water vapor pressure reaches at least 18.8 mb at not less than 20 C at any one of the observation times (7AM, 1PM, 5PM). A correlation coefficient of 0.16 was found between air pollution and temperatures exceeding 25 C on the basis of 164 measurements made in 1959. The correlation factor was 0.27 for days on which the temperature went above 30 C. The importance of orienting buildings so as to take full advantage of prevailing winds is stressed.

6670 APTIC NUMBER 16364

Sachdev, B. M. and P. D. Mavlani
TURBULENCE STATISTIC STUDIES AT TROMBAY WITH A NEW WIND SYSTEM. J. Appl. Meteorol., vol. 7:981-985, Dec. 1968. 5 refs.

An electronic wind analysis system for turbulence studies near a nuclear reactor site was designed to compute the standard deviation of wind direction fluctuations from measurements of the accumulated value of the displacements of a wind vane during a predetermined interval and the number of reversals of wind direction during the same interval. Measurements are made with an optical encoder. The instrument can be adapted to study the variation of standard deviation from a few minutes to several hours. It can also be used for meteorological support when the standard deviation of wind direction fluctuations are required during a tracer release in diffusion experiments. Field studies indicate that the effects of nonstationary and local obstructions to wind flow make it impossible to estimate values of the standard deviation of wind direction fluctuations over uneven terrain on any one occasion. However, median values of observed standard deviations of wind direction fluctuations can be related to wind speed, wind direction, and time of day. The effect of local obstructions on the standard deviations is almost double in magnitude when the wind vane is downwind from an obstacle. A diurnal cycle in turbulence intensity is observed: the largest median values occur during late afternoon hours.

6671 APTIC NUMBER 16403

Skoda, J.
NOMOGRAMS FOR CALCULATING MAXIMUM SO2 CONCENTRATIONS NEAR THE GROUND. (Nomogramy pro vypocet maximalni prizemni koncentrace SO2). Text in Czech. Ochrana ovzdusi, no.6:93-98, 1969. 1 ref.

Three nomograms are presented which serve to correlate the following set of variables: maximum regional concentration at critical wind velocity (mg SO2/cu m); isotropic maximum concentration at critical wind velocity (mg SO2/cu m); distance to maximum concentration measured from the foot of the chimney (km); chimney height (m); amount of sulfur carried by the fuel (kg S/hr); temperature difference between burning fuel and surrounding air (degrees C); and volumetric discharge at normal temperature and pressure (cu m/sec). Five sample problems are worked out.

6672 APTIC NUMBER 16347

Solomon, Allen M. and Murray F. Buell
EFFECTS OF SUBURBANIZATION UPON AIRBORNE POLLEN. Bull. Torrey Botan. Club, 96(4):435-444, July-Aug. 1969. 23 refs.

Yearly totals of four daily atmospheric pollen surveys, conducted in Yonkers, New York, during 1932, 1954, and 1967, were analyzed for qualitative and quantitative changes. A striking numerical decrease in herb pollen was recorded, with the 1967 total little more than one half that of the 1932 total. Decreases occurred in all herb taxa except Artemisia, with Gramineae and Ambrosia demonstrating the greatest decline. This change seems directly related to the massive suburbanization occurring to the north and west of the sampling site after World War II, resulting in a similar massive decrease in sites available for the growth of wind-pollinated herbs. (Author abstract)

6673 APTIC NUMBER 15712

WHERE DOES IT ALL GO. Stanford Res. Inst. J., 23:4-8, Dec. 1968.

The Environmental Research Department of Stanford Research Institute undertook a global study of the atmosphere. The world and its surrounding atmosphere were considered as a complete system. Estimates were made of the amount of sulfur compounds, nitrogen compounds, organic compounds, and inorganic carbon compounds discharged to the air by automobiles, home furnaces, or power plants. Calculations were made of the amount of the material in the atmosphere. By comparing the two figures it was possible to estimate how effectively nature removes pollutants from the atmosphere. Included in the atmospheric balance was the amount of material contributed by nature since there are natural sources for a wide variety of gaseous materials and particles which are classed as air pollutants when they are emitted by man's activities.

6674 APTIC NUMBER 16237

Stone, G. M. and A. J. Clarke
BRITISH EXPERIENCE WITH TALL STACKS FOR AIR POLLUTION CONTROL ON LARGE FOSSIL-FUELLED POWER PLANTS. Preprint, Illinois Inst. of Tech., Chicago, 12p., 1969. 20 refs. (Presented at the American power Conference Annual Meeting, Chicago, April 1967.)

British experience in the use of tall stacks to control emissions from power plants in England and Wales is summarized. Factual evidence gathered during 15 years of routine monitoring surveys, sulfur dioxide surveys, and dispersion studies is presented in support of the effectiveness of tall stacks. In all plants, peak SO2 concentrations at any ground level point are transient and infrequent, and their magnitudes are accurately predicted. No meteorological situation has been encountered in which short-term peak concentrations are more than double those in neutral conditions. Hot plumes from tall stacks rise high in stable atmospheric conditions, making virtually no contribution to ground level pollution. Because plume rise is high, stable lower atmosphere layers frequently shield the ground surface. It is concluded that modern power plants with tall stacks can operate for extended periods without adding to the general pollution level of the immediate area. Similarly, all plants in a large geographical area can collectively operate without any detectable influence on the trend of ground level SO2 concentrations at remote areas. Chimney stack parameters at various fossil-fuel stations and the results of an 11-month recording of hourly-mean SO2 concentrations (pphm) from all sources and from one power plant station alone are presented in tables. The plant's short term and time-mean concentrations during winter and summer are also tabulated. A diagrammatic representation is included of plume dispersion under different conditions of atmospheric stability.

6675 APTIC NUMBER 15942

Suleymanov, D. M. and V. A. Listengarten
CHEMICAL COMPOSITION OF PRECIPITATION ON THE APSHERONSK PENINSULA. (O khimicheskom sostave atmosfernykh osadkov apsheronskogo polvostrova). Text in Russian. Dokl. Akad. Nauk. Azerb. SSR, 22(12):42-44, 1966. 1 ref.

Analysis is based on 55 snow and rain samples taken at Baku and to the north of Novkhana. The overall mineralization of precipitation was found to be about the same in these two regions. In most cases, the occurrence of anions was in the descending order: HCO3, SO4, and Cl. When the total mineral residue was less than 7 mg/l, the cation content in descending order was Ca, Na plus K, and Mg; with a residue greater than 7 mg/l the order was Na plus K, Ca, and Mg. Frequently the Mg ion was lacking. Average annual values in mg/l are: Cl, 7.1; SO4, 17.6; NO3, 0.6; HCO3, 63.1, Na plus K, 20.7; Mg, 1.5; and Ca, 11.9; total dry residue is 102.1. This source of salts is seen as an important factor in connection with land reclamation and the formation of ground water.

6676 APTIC NUMBER 16265

Turner, D. Bruce
URBAN ATMOSPHERIC DISPERSION MODELS--PAST, PRESENT, AND FUTURE. Preprint, Air Pollution Control Assoc., Mid-Atlantic States Section, 27p., 1969. 38 refs. (Presented at the Air Pollution Control Association, Mid-Atlantic States Section Meeting, Philadelphia, March 21, 1969.)

Urban dispersion models are defined and reviewed. These models imply multiple sources and incorporate a coordinate system for the area of interest. This usually takes the form of axes pointing East and North. A second coordinate system is used with the dispersion equation, with the x-axis indicating the direction of mean wind. Switching between these axes systems requires a rotation and translation with analytic geometry. Most models incorporate a continuous plume dispersion equation representing dilution by wind speed and dispersion in the horizontal and the vertical which can be considered perpendicular to the mean motion of the plume. For descriptions of sources, the emission rates, location, and effective height of emission are needed. Values of meteorological parameters required for models are wind direction and speed, averaged for two hours. Models also require measures of vertical stability through the lower layer of the atmosphere or appropriate fluctuation statistics from wind vanes or bi-directional wind vanes. Determining the variation in concentration over an area by dispersion models contributes to air pollution control efforts by showing where critical concentrations will occur under specified meteorological conditions; indicating areas and sources requiring the highest priority for abatement action; and assisting in locating sampling stations. Dispersion models are subject, however, to errors in emission estimates, meteorological parameter estimates, and approximations of transport and dispersion processes. Programs underway in NAPCA and ESSA will reduce some of these problems. The use of computers will also help in verifying dispersion models. The effect of interpolation for a sampling station between grid points is presented for sulfur dioxide.

6677 APTIC NUMBER 16450

Ukeguchi, Nobuhiro and Yukio Arita
WIND TUNNEL TESTING ON STACK GAS DIFFUSION. (Entotsu haigasu no kakusan ni kansuru fudo-shiken). Text in Japanese. Mitsubishi Tech. Bull., no. 04018N, 15p., Sept. 1965. 17 refs.

The height, dispersion, and ground level concentration of stack gas after emission were studied experimentally by the use of a wind tunnel. The wind tunnel used in this experiment had a measurement room of 800 mm by 550 mm by 2500 mm in size, a static pressure of 220 mm Ag, a wind volume of 430 cum/min, and a wind velocity of less than 10 m/sec. For the experiment of a wider area, a larger room (2.5 m by 1.0 m by 9.0 m in size) was used. The height of the stack gas by the mechanisms of momentum and floating is increased with the increase of the amount and emission velocity of the gas. The dispersion of the stack gas varies with the influence of climate, temperature, substance(s) on the surface of the ground, and the topography; the downwash and/or downdraught may occur under these circumstances. The high concentration, downwash and downdraught can be avoided by increasing the height of the stack and by increasing the emission velocity of the stack gas. The emission velocity of the gas should be more than twice as great as the wind velocity around the exit of the stack, and the height of the stack should be about 2.5 times as great as that of the highest building around the stack.

6678 APTIC NUMBER 16405

Valko, P.
RELATIONSHIP BETWEEN TURBIDITY FACTOR AND TURBIDITY COEFFICIENT. (Ueber den Zusammenhang zwischen Truebungsfaktor und Truebungskoeffizient). Text in German. Arch. Meteorol., Geophys., Bioklimatol., Ser. B, 15(4):359-375, 1967. 17 refs.

The measurement of atmospheric turbidity by determining the solar intensity can indicate the rate of air pollution. If the turbidity is to be studied over a period of several years, the methods of evaluation may have changed and thus, different turbidity measurements may have to be compared with each other. A diagram was developed for the conversion of the turbidity factor for total radiation by F. Linke into the turbidity coefficient by W. Schuepp and vice versa with sufficient accuracy. The conversion takes into account the precipitable water content of the air and of the optical air mass. The extensive measurements taken at Locarno-Monti (southern Switzerland) are used to analyze the influence of the wave length exponent alpha on the conversion. Empirical formulas are compared with those provided in the literature and with the theory.

6679 APTIC NUMBER 15950

Ventura, Eduard
THE RELATIONSHIP BETWEEN THERMAL INVERSIONS AND AIR POLLUTION. (Inverziok kapcsolata a legszennyezodessel). Text in Hungarian. Idojaras, 70(5):285-293, 1966. 5 refs.

A correlation is established between air pollution levels and thermal inversion in the Budapest area. The inversion characteristics are based on the 1960-1964 data from Budapest radiosonde ascents (4 daily flights in the lower 3 km of the atmosphere) and on air pollution data. The inversion definition is based on gradients less than 0.1 C/100 m. The correlation between inversions and wind direction and velocity is also given. An R equals 0.74 correlation coefficient was found between the monthly mean air pollution and the monthly frequency of inversion. The probable error is 7% of R.

6680 APTIC NUMBER 16467

Volchin, V. G.
THE DISTRIBUTION OF SURFACE CONCENTRATIONS OF HARMFUL ADMIXTURES IN REGION OF POWER STATION IN ODESSA. (Raspredeleniye prizemnykh kontsentratsiy vrednykh primesiy v zone Odesskoy TETs). Text in Russian. Meteorol., Klimatol. i Gidrol., no.3:38-45, 1968. 6 refs.

Measurements of aerosols and SO2 are taken as a basis in this study of air pollution resulting from the combustion of coal at the Odessa Heat and Power Plant. Maximum pollution from the plant (at a distance of 2400 m from the stack) reached 0.27 mg/sq m for SO2 and 0.20 mg/cu m for aerosols, or 40-50% of the total concentration in the surrounding areas. Pollution concentration under the plume reaches as high as 0.6-0.7 mg/cu m, a north-south orientation predominating due to prevailing winds. Under anomalous conditions of atmospheric stratification the maximum permissible concentration (0.5 mg/cu m for both SO2 and aerosols) may be exceeded 2-3 fold. The area within a 3-4 km radius of the Odessa industrial region is deemed unsuited for the construction of new multiple-dwelling structures because of high pollution levels.

6681 APTIC NUMBER 16546

Ware, G. W., Betty J. Estesen, W. P. Cahill, P. D. Gerhardt, and K. H. Frost
PESTICIDE DRIFT. I. HIGH-CLEARANCE VS. AERIAL APPLICATION OF SPRAYS. J. Econ. Entomol., 62(4):840-843, Aug. 1969. 7 refs.

Two experiments are reported which compare pesticide drift following aerial application of methoxychlor with that following application by a high-clearance, self-propelled ground sprayer. Emulsion sprays were applied simultaneously by the two methods to skip-row cotton in late evening and early morning. The drift was collected by glass plates, cascade impactors, and Andersen air samplers. At all distances, beneath target and downwind, the aerial application resulted in greater drift than the ground application. The aerial drift following evening application at 1320 ft was 5.0 times that of the ground spray. Following morning application at 600 ft, it was 4.2 times that of the ground spray. Cascade impactor and Andersen air-sampler data were in complete agreement with the glass-plate collections. The Andersen air sample reported here for the first time as a drift-measuring device compares favorably with the cascade impactor and should serve as a useful tool in drift determinations.

6682 APTIC NUMBER 16384

Weisser
FORESTS AS NATURAL PROTECTION BARRIERS AGAINST AIR POLLUTION BETWEEN ADJACENT INDUSTRIAL AND RESIDENTIAL AREAS. Preprint, 1961 (?). 10 refs. Translated from German by Edith H. Johnson, 9p.

Forests and even small parks play an important role as air cleaning agents. Air traveling through the sieve-like mass of foliage is filtered by the many surfaces of branches, leaves, needles, and hairs, and particulates are caught and held. This material is washed to the ground by the next strong rain, preparing the foliage for further filtering. In addition, dust-carrying winds passing through the forested area are slowed, causing the dust to settle out. It is estimated that 2-1/2 acres of spruce can hold about 32 tons of dust and a similar area of beech, 45 tons. Vegetation plays a critical role in the oxygen-carbon cycle of human and animal respiration by taking up CO2 and oxygen from the atmosphere and returning oxygen; it also refills the CO2 supply through the microbiotic decomposition of organic material. When the air taken in by vegetation is polluted, it is detoxified at the cost of deleterious effects of the pollutants on the plants. A circumferential urban green belt is important in providing sources of cool air to replace warmed city air, permitting the latter to rise and diffuse. Needled trees suffer more severly from smoke damage than leaved trees; the fir is the most susceptible, followed by spruce, various species of pines, and

larch. Oaks, alders, birches, beeches, and maples are among the more resistant leaved varieties. Therefore, forest management policies in heavily smoke-damaged areas aim toward replacing injured needled trees with leaved wood, both to preserve the health of the forest and to help in whatever degree possible in lessening atmospheric pollution.

6683 APTIC NUMBER 16475

Yordanov, D.
DIFFUSION IN THE WIND DIRECTION IN THE GROUND LAYER OF AIR WITH UNSTABLE STRATIFICATION. (Difuziya po posoka na vyatura v prizemniya vurdushen sloy pri neustoychivo nasloyavane). Text in Bulgarian. Izv. Geofiz. Inst. Bulgar. Akad. Nauk, vol. 6: 21-28, 1965. 3 refs.

The transient distribution is calculated of the concentration of an air pollutant emitted, under free convection conditions and in the presence of a horizontal wind of constant speed U, blowing in the direction of X positive, at any given instant t equals t sub 0 by an instantaneous point source located at the point X equal 0, Y equals 0, and Z equals 0. By the principle of superposition, the integral of the new expression with respect to instant of emission t sub 0 from the infinite past, t sub 0 equals minus infinity, to the current instant, t sub zero equals t, represents, in the same half-space, the stationary distribution of the air pollutant emitted, under the same convection and wind conditions, by a continuous point-source located at the same point, and shows under what special conditions that expression reduces to that for the stationary distribution of the concentration of an air pollutant emitted by a continuous point source located at 'high' altitude Z equals C above an impermeable plane Z equals 0 in the presence of an unstable condition of the air near the ground, derived in another previous paper.

6684 APTIC NUMBER 16477

Yordanov, D. and M. Kovacheva
DIFFUSION OF A PASSIVE ADMIXTURE IN THE GROUND LAYER OF AIR WITH UNSTABLE STRATIFICATION. (Difuziya na pasivna primes v prizemniya v'rdushen sloy pri neustoychivo nasloyavane). Text in Bulgarian. Izv. Geofiz. Inst. Bulgar. Akad. Nauk, vol.6:13-19, 1965. 12 refs.

Analytical expressions were derived for the stationary distribution of the concentration of a passive air pollutant emitted by a continuous point source located at the altitude Z equals C above the ground for the two cases, when C is greater than -L and when C is less than -L, where L is the 'length scale' of turbulence. The wind profile and the coefficient of turbulence exchange were chosen on the basis of similitude considerations. The form to which the expression for the case when C is less than -L reduces when C equals 0 provides the basis for a photographic determination of the horizontal coefficient of turbulence exchange at right angles to the direction of the wind. Working formulas based on this assumption are given. The experimental finding that the change of the exponent of Z in the expression for the concentration distribution due to a change of the stability parameter is quite insignificant must be ascribed to the fact that a point source located on the ground was used and that most of the diffusion took place in the dynamic substratum of the ground layer.

6685 APTIC NUMBER 16414

Yordanov, Dimit'r
EFFECT OF WIND PROFILE ON DIFFUSION IN THE NEAR-GROUND LAYER WITH UNSTABLE STRATIFICATION. (Vluyaniye na profila na vyat'ra v'rkhu difuziyata v prizemniya sloy pri neustoychiva stratifikatsiya). Text in Bulgarian. Izv. Geofiz. Inst. Bulgar. Akad. Nauk., vol. 9:23-30, 1966. 4 refs.

A diffusion equation is solved for an infinitely long source with unstable stratification, the wind profile and coefficient of turbulent exchange being derived from similarity theory. Numerical calculations are tabulated and plotted. It is demonstrated that wind profile must be taken into account close to a low-lying source and at low altitudes above the earth's surface. Simple asymptotic representations of solutions are presented which possess a clear physical significance and serve to evaluate applicability.

6686 APTIC NUMBER 16462

Adadurov, I. Ye., D. V. Gernet, and A. V. Shuryayeva
EFFECT OF CARRIERS AND DILUENTS ON ACTIVATION ENERGY AND DISPERSION COEFFICIENT. (Vliyaniye nositeley i razbaviteley na energiyu aktivatsii i velichinu koefetsienta rasseyaniya). Text in Russian. Zh. Fiz. Khim, 7(3):451-464, 1936. 13 refs.

Studies of catalytic reactions involving a chromium-tin catalyst demonstrated that: 1) as the applied catalyst layer is increased, the distorting effect of the substrate is reduced; 2) the distorting effect of the substrate is greater the smaller the radius of its cation and the greater its charge; 3) disruption of catalytic action is greater the greater the radius of its cation and the smaller its charge. Experimental data relate to oxidation of SO2 to SO3. The catalyst was tested on porcelain, Al2O3, Fe2O3, Al2O3, and MnO2 substrates. Catalyst diluents used were calcium sulfate, strontium sulfate, barium sulfate, thoric oxide, ceric oxide, and zirconium dioxide. Rate constants, temperatures, and activation energies for maximum conversion are tabulated for various catalyst combinations. An exponential dependence of the coefficient of activity on activation energy is revealed, the dispersion coefficient depending on the method of preparation of the catalyst and hence on the kinetic conditions of formation of active centers.

6687 APTIC NUMBER 16088

Adadurov, I. Ye. and D. V. Gernet
POISONING OF CHROMIUM CATALYSTS BY ARSENIC AND OTHER CONTACT POISONS. (Ob otravlyayemosti khromovykh katalizatorov mysh'yakom i drugimi kontaktnymi yadami). Text in Russian. Zh. Prikl. Khim., 8(4):612-627, 1935. 18 refs.

A number of conclusions are drawn from a review of available data on SO2 and SO3 adsorption by chromium catalysts. A chromium-tin-barium catalyst, like vanadium-tin-barium catalysts, is subject to arsenic poisoning. At 450-475 C, after absorption of a definite quantity of As2O3 (0.5 g per 1⁸ ml), the catalytic activity of the chromium catalyst drops more rapidly than with vanadium catalyst, at 500 C poisoning of both chromium and vanadium proceeds similarly, while at 550 C neither is affected by the arsenic. A reduction in catalytic activity is accompanied by the obstruction of the active surface by arsenic anhydride, formed through the oxidation of As2O3. A poisoned catalyst can be regenerated with carbon monoxide, however, regeneration with a CO-H2 mixture has a destructive effect, since the hydrogen reduces SnO2 to the metal which oxidizes when the reducing agent is removed, thus resulting in separate layers of Cr2O3 and SnO2 having reduced effectiveness. The smell of hydrogen sulfide present when attempting regeneration with H2 indicates the presence of either adsorbed sulfur or sulfite on the catalyst surface. The presence of water vapor has no practical adverse effect on catalyst activity. Moist HCl vapor causes reversible poisoning and catalytic activity is fully recovered when access to this vapor ceases. Catalytic activity is not reduced by dry HCl gas. Possible reaction mechanisms are given.

6688 APTIC NUMBER 16097

Adams, G. E. and B. D. Michael
THREE STAGE ELECTRON TRANSFER IN AQUEOUS AND ALCOHOLIC SOLUTIONS. Nature, 215(5107):1248-1250, Sept. 16, 1967. 16 refs.

The use of pulse radiolysis to explore the radiation chemical behavior of compounds of high electron affinity was discussed. The acceptors used were acetone, acetophenone, benzophenone, fluorenone, N-ethylmaleimide, dimethylfumarate, nitrous oxide, and oxygen. Solutions in either triply distilled water or highly purified ethanol were made alkaline with potassium hydroxide and sodium ethoxide respectively. Samples were irradiated with a 0.2 potassium hydroxide and sodium ethoxide respectively. Samples were irridiated with a 0.2 microsecond pulse of 1.8 MeV electrons from a linear accelerator, and the transient changes in optical density were recorded spectrophotometrically. Transient spectra of several deoxygenated, aqueous, alkaline solutions of acetopheone, benzophenone, and acetone were shown. The absorption maximum of 4400 A was assigned to the electron adduct of acetopenone while the peak at 3700 A was caused by the OH adduct. In the presence of high concentrations of acetone, the 3700 peak was suppressed because the precursors, OH radicals, are scavenged by the solute. It was concluded that the 4400 A maximum was due to the electron transfer reaction. A set of similar data for acetone and benzophenone showed the same results. In a system of acetone, acetophenone, benzophe.. ne and potassium hydroxide, acetone must scavenge all hydrated electro.s, and therefore the sequential formation of the two ketyl anions indicates the occurrence of a simple three-stage chain electron transfer process. In the presence of oxygen, the radical anions of fluorenone, benzophenone and other acceptors, produced by electron attachment or by chain electron transfer, decay by an exponential process. In all cases, the half times are inversely proportional to oxygen concentration, indicating that reaction takes place. No evidence was found for peroxyanion-radical formation which would favor the mechanism of electron transfer rather than oxygen addition for reaction. In alkaline ethanolic solutions saturated with nitrous oxide, the first order rate constants for electron transfer to fluorenone were proportional to the fluorenone concentration.

6689 APTIC NUMBER 16084

Albertson, Noel F. and W. Conrad Fernelius
ADDITION COMPOUNDS OF SULFUR DIOXIDE. J. Am. Chem. Soc., vol. 65:1687-1690, Sept. 1943. 21 refs.

Phase diagrams are presented for binary systems of sulfur dioxide with ethylene oxide, acetone, dioxane, anisole, diethyl sulfide, and methyl aniline. The following new compounds are reported: dioxane-sulfur dioxide (1:1 and 1:2), ethylene oxide-sulfur dioxide, anisolesulfur dioxide, and diethyl sulfide-sulfur dioxide. Solutions containing 0.556 and 0.559 mole fraction of ethylene oxide in an ethylene oxide-sulfur dioxide system exhibited unusual cooling curves. The first half of the cooling curve was perfectly normal but, after a drop of a few degrees below the melting point, the temperature suddenly rose and a constant temperature was maintained again for several minutes before the



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solution started to cool once more. No other mixtures gave results of this nature. The system dioxane-sulfur dioxide showed a second break in the cooling curve occurring at a higher temperature than the first. Solutions containing more than 80% sulfur dioxide undercool slightly. A very unstable 1:1 compound was found to exist between anisole and sulfur dioxide at -70 deg. Solutions in the neighborhood of the eutectic gave glasses upon cooling. Acetone-sulfur dioxide mixtures in the neighborhood of eutectics were difficult to crystallize without undercooling. The observed maximum of -48 deg was observed for diethyl sulfide-sulfur dioxide. The system shows such great tendency to undercool that all of the points between the eutectics are believed to be low. The observed undercooling decreases in a regular fashion on either side of the 1:1 mixture. There was a great tendency to form glasses over all concentration ranges in the system methylaniline-sulfur dioxide. The region between 82 and 100 mole % methylaniline could not be crystallized.

6690 APTIC NUMBER 15972

Albright, Lyle F., Paul T. Shannon, Sun-Nien Yu, and Ping Lin Chueh
SOLUBILITY OF SULFUR DIOXIDE IN POLAR ORGANIC SOLVENTS. Chem. Eng. Progr. Symp. Ser., vol. 59(44):66-74, 1963. 8 refs.

The solubility of sulfur dioxide was measured in the polar organic solvents tetraethylene glycol dimethyl ether; N,N-dimethylformamide; N,N-dimethylacetamide; 2-octanone; ethyl laurate; nitrobenzene; and n-heptyl alcohol at 77, 100, 150, and 200 F and at pressures up to approximately 300 lb/sq in. abs. As indicated by plots of equilibrium pressure against liquid composition at constant temperature and a comparison of activity coefficients, tetraethylene glycol dimethyl ether and the substituted amides are the best solvents for sulfur dioxide. The activity coefficients for nitrobenzene, ethyl laurate, and 2-octanone are of special interest, since the solutions show relatively small negative deviations from ideality at low sulfur dioxide concentrations, but slightly positive deviations at higher concentrations. The implication is that the types of complexes formed between the solvent and sulfur dioxide may vary with the sulfur dioxide concentration in the liquid phase. The solubility characteristics of sulfur dioxide in polar solvents are very similar to those of chlorofluoromethanes containing one hydrogen atom, suggesting that solubility of sulfur dioxide in polar solvents results from complexes formed between the positive sulfur dioxide and the electronegative polar group of the solvent. The solubility data was satisfactorily correlated and tested for experimental consistency by the Mastrangelo method but with a different mathematical model. Heats of mixings calculated from the solubility data were found to be maximum at a mole ratio of solute to solvent very close to the functionality of the solvent.

6691 APTIC NUMBER 16452

Allemagny, Paul
STUDY OF ALKALI-METAL PEROXIDES AND OF ALKALINE-EARTH-METAL PEROXIDES. (Etude sur les peroxydes alcalins, et sur les peroxydes alcalino-terreux). Text in French. Rev. Chim. Minerale, 2(4):645-676, 1965. 53 refs.

The methods of preparation of the following systems were studied: Na2O2 by direct oxidation of solid Na; Li2O2, MgO2, CaO2, SrO2 and BaO2 from aqueous solutions of the respective peroxyhydrates; K2O2, Rb2O2, RbO2, Cs2O2 and CsO2 by passing an 80% O2-20% N2 mixture through respectively, K-, Rb- and Cs- solutions in liquid ammonia; and KO2, by direct oxidation of molten K. The identity of these peroxides and superoxides was established by chemical analysis and confirmed by x-ray diffraction analysis of their crystal structure. The spectral lines and their intensities of powder x-ray spectra of (MgO2)2.H2O, MgO2, and Rb2O2 were tabulated. The previously unknown crystal lattices of the first two were face-centered cubic with lattice constants a equals 4.88 A and a equals 4.80 A, respectively; Rb2O2 was cubic with a lattice constant of a equals 9A and 8 molecules per unit cell. The previously known orthorhombic Rb2O2 appeared to be a metastable allotrope. The identity of KO2, RbO2, and CsO2 was also verified by measuring their magnetic susceptibility at 20 C in magnetic fields of 3145 to 10,280 oersted. The magnetic susceptibility at 20 C in a magnetic field of 4700 oersted of K2O2, Rb2O2, and Cs2O2 was determined for comparison. Thermolyses of KO2, RbO2, and CsO2 were carried out by heating the samples at the constant rate of 50 C per hour in vacuo or in and argon atmosphere, and recording their loss of weight by a thermobalance. Cryoscopic studies were performed on KCl, NaCl, BaCl2, NaNO3, Li2O2, Na2O2, Rb2O2, Cs2O2, MgO2, CaO2, SrO2, BaO2, RbO2 and CsO2, using the LiNO3-KNO3 eutectic melt at 127 C as the solvent, as well as on K2O2 and KO2, using molten LiNO3 at 250 C as the solvent. The results of these measurements were tabulated.

6692 APTIC NUMBER 16386

Allan, R. S., C. W. Skeet, and O. I. Forgacs
REFINER GROUNDWOOD FROM DECIDUOUS SPECIES. Can. Pulp Paper Assn., Tech. Sec., Tech. Paper T351: T351-T357, 1968. 7 refs. (Presented at the Sixth International Mechanical Pulping Conference, Atlanta, Ga., May 14-17, 1968.)

A pilot plant investigation of the possibilities of mechanically pulping certain Canadian hardwood species to yield 90% and more is described. The experiments were limited to direct chip refining and to refining after mild pretreatment in an 'Impressafiner.' The properties of news groundwood from spruce were used as a target of pulp quality. Of trembling aspen, white and yellow birch, and red and sugar maple, only aspen could be pulped to reasonable strengths and freeness by direct reduction alone. Impregnation with sodium hydroxide resulted in major increases in pulp strength for all species but also major losses in brightness. For aspen and white birch, brightness in the 54-58 point range was obtained through addition of sodium sulfite to the impregnation liquor. Yellow birch and the maples had brightness about 10-15% below this level, and would require extensive bleaching to be acceptable for newsprint. Maple chips did not meet the target strength values. For these species, extended soaking times in the reagent and elevated temperatures are required in the pretreatment. The specific refining energy required to create a given specific surface correlated strongly with green wood properties such as tensile strength perpendicular

to the grain. The higher these strength properties, the more drastic is the chemical treatment required to produce strong semi-mechanical pulps. (Author conclusions modified)

6693 APTIC NUMBER 16275

Allison, S. A. and R. M. Barrer
CLATHRATION BY PHENOL AND QUINOL. PART 2. KINETICS. Trans. Faraday Soc., 64(2):557-565, 1968. 11 refs.

An investigation was made of the kinetics of reactions between various guest molecules and alpha-phenol and alpha-quinol crystals. The reactions were strongly promoted by mechanical agitation of the crystals, and reactions normally did not occur in the absence of shaking. With alpha-quinol, a small initial uptake of gas was followed by a second large uptake. With alpha-phenol, the initiation time was not preceded by any initial uptake. Initiation times were pressure dependent and temperature independent. The amount of clathrate formed in the uptake following the initiation time at first varied linearly with time, but later with the square of the amount of unreacted alpha-phase. The properties of the initiation time and the study of kinetic runs with interrupted shaking, and with preliminary shaking in vacuo followed by permanent cessation of shaking, suggest that fluctuations in the organization of phenol and quinol molecules are the result of the constant bombardment of their crystals during shaking. The disordered reactive material produced reorganizes after initiation to yield the clathrate Beta-phase. Shaking further catalyzes the reaction by ensuring a continuous supply of reactive material and by breaking layers of clathrate Beta-phase off the surfaces of the alpha-phase, thus continually exposing fresh reactant surfaces. (Author abstract modified)

6694 APTIC NUMBER 16483

Anderson, James B.
SEPARATION OF GAS MIXTURES IN FREE JETS. Am. Inst. Chem. Engrs. J., 13(6):1188-1192, Nov. 1967. 21 refs.

Spatial distributions of species flux in axisymmetric free jets of helium-argon mixtures were determined experimentally. The experiments encompassed the transition range between inviscid and free molecular flow at the exits of the nozzles forming the jets. Comparison is made with existing theories of separation. The results confirm the validity of predictions and measurements of diffusive separation for nearly inviscid flow. In the transition range departures from the nearly inviscid theory occur. The maximum degree of separation is observed in this range. It is concluded that separation in free jets is due primarily to pressure diffusion in the expanding jets rather than to free molecular flow. Separation at a probe or sampling tube occurs due to the deceleration of gas; in many cases this separation is substantial. (Author abstract modified)

6695 APTIC NUMBER 16397

Andrew, S. P. S.
A SIMPLE METHOD OF MEASURING GASEOUS DIFFUSION COEFFICIENTS. Chem. Eng. Sci., 4(6):269-272, 1955. 4 refs.

A knowledge of the gaseous diffusion coefficient for a specified gas mixture is frequently necessary in designing absorption and stripping towers. A new measurement method enables coefficients to be readily obtained with sufficient accuracy for design purposes. It consists essentially of measuring the amount of equimolar counter-diffusion occurring in a diffusion tube connecting two flasks containing initial gas mixtures of different concentrations. Values of diffusion coefficients obtained by this method were compared with previous measurements for two of the gases, and satisfactory agreement was found. Coefficients were given for the diffusion of CO2, NH3, SO2, Cl2, and Br2 at 20 C and 760 mm Hg. (Author abstract modified)

6696 APTIC NUMBER 16376

Arai, Yasuo, Hiroshi Takenouchi, and Shoichiro Nagai
REACTIONS BETWEEN CAO AND SO2: ABSORPTION MECHANISM OF SO2 INTO QUICK LIME (I). (CaO to SO2 to no hanno shosekkai no SO2 kyushu kiko (dai 1 ho)). Text in Japanese. Sekko to Sekkai (Gypsum Lime), no. 44:5-11, 1960. 14 refs.

Equilibrium in the system CaO-SO2 was investigated at various temperatures to determine the absorption mechanism of sulfur dioxide gas in quick lime. Pure sulfur dioxide gas was introduced into a heat tube containing calcium dioxide (sic) powder; velocity of the gas was maintained at 200 cc/min. The reaction products between the solid and gas phases were investigated by chemical analysis and X-ray power diffraction. Absorption velocities of SO2 in quick lime prepared from limestone calcined at various temperatures were measured. Results showed that the amount of combustible sulfur varies according to the coal used. Sulfur is easily oxidized to sulfur dioxide and volatilized with other combustion gases by firing coal at 600 to 800 C under leading of air. Reactions between CaO and SO2 are minimal below 400 C, but calcium sulfite is produced by the reaction: CaO + SO2 yields CaSO3, above 400 C. With rising temperatures, the amount of calcium sulfate formed by decomposition of calcium sulfite increases according to the reaction: 4CaSO3 yields 3CaSO4 + CaS. Above 800 C, the equilibrium between calcium oxide and calcium sulfate is such that both sulfite and sulfide are converted to sulfate by contact with air. The semi-stable zone of sulfite and sulfide can extend from 400 to 800 C. Beyond 1000 C, calcium oxide loses its ability to absorb sulfur dioxide as the process of decomposition progresses. (Author abstract modified)

6697 APTIC NUMBER 16605

Asinger, Friedrich
THE PRODUCTS OF THE COMMON INFLUENCE OF SULFUR DIOXIDE AND CHLORINE ON ALIPHATIC HYDROCARBONS IN ULTRAVIOLET LIGHT. IV PART: THE PRODUCTS OF THE COMMON INFLUENCE OF SULFUR DIOXIDE AND CHLORINE ON

N-DODECANE. (Zur Kenntnis der Produckte der gemeinsamen Einwirkung von Schwefeldioxyd und Chlor auf aliphatische Kohlenwasserstoffe in ultravioletten Licht, IV. Mitt.: Die Produkte der gemeinsamen Einwirkung von Schwefeldioxyd und Chlor auf n-Dodecan). Text in German. Chem. Ber., 77-79(3-4):191-198, 1944. 13 refs.

In a study of the reactions of high molecular straight-chained paraffines hydrocarbons to sulfochlorination, n-dodecane was subjected to a partial sulfochlorination to avoid excessive di and polysulfochloride formation. The sulfcchlcrides were liberated from the unconverted hydrocarbon through selective extraction with liquid SO2. Di and polysulfochlorides were precipitated from mixtures with monosulfochlorides with pentane. The mixture of monosulfochlorides was then desulfurized, leaving a mixture of dodecyl chlorides in which the chlorine assumed the same position as previously held by the sulfochloride group. The dodecyl chloride mixture was converted into dodecylenes with silver stereate. From 100 g of dodecylene mixture 87g water-insoluble fatty acids were obtained. The composition of the individual acids in mol percent was: C6 17.2, C7 18.6, C8 16.6, C9 19.2, C10 18.1 and C11 10.3.

6698 APTIC NUMBER 16258

Ankar'yan, G. A.
EXCITATION AND DISSOCIATION OF MOLECULES IN AN INTENSE LIGHT FIELD. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i Teor. Fiz.), 19(1):273-278, Jan. 1964. 2 refs.

The possibility and conditions for the direct dissociation of molecules in a very intense light field were discussed. The magnitude of the effect was estimated by means of simple quasiclassical calculations. In homopolar molecules, the difference between the nonresonance and resonance interactions as a function of the mutual positions of the interacting atoms and the direction of the electric vector of the light wave were noted. At the same values of the various quantities involved, the dissociation of heteropolar and ionic systems was more intense. The strongest dissociation effect appeared when the atoms lay along the direction of the electric field. For the dissociation of homopolar molecular ions, light fields of higher frequencies were used, modulated or rotating at a frequency close to the vibration resonance. It was concluded that it is possible to use an intense light field with resonance carrier or modulation frequencies for effective excitation and dissociation. The effects considered may be used to intensify the effect of light on molecular media or on micro-objects in order to dissociate beams on fast atoms or ions entering a trap thus obtaining an atomic beam from a molecular beam, or to directly heat the molecules of a medium.

6699 APTIC NUMBER 16267

ADVANCES IN VEHICLE ELECTRICS. Automotive Design Eng., vol. 7:42-43, Dec. 1968.

Advances which have been made in vehicle electrical systems and the various items of equipment which have been developed are discussed. The permanent magnetic alternator lent itself to the development of an integrated charging system, combining both generating and regulating functions in a small package. A battery protector unit was designed to give the driver prior warning when the battery energy is almost expended and allow him sufficient power for starting purposes to avoid a completely flat battery. Two safety features built into the protection unit are a voltage differential to preclude hunting and a time delay, so that it will not trigger because a transient voltage drop when the starter motor is operated. A series of voltage conversion units were designed for use by trailer manufacturers who require their trailers to be hauled by either a 12 or 24 volt prime mover. Advantages claimed for flat strip wiring are as follows: as the conductor cable fully utilizes the properties of the conductor and insulation materials, it saves space, ensures a high strength/weight ratio, and give maximum flexing life. Greater heat dissipation is also achieved. Quartz halogen lighting units were adopted and provide greater intensity of the light output and better definiation of the projected beam. Accessory lights also underwent development and both fog and spot lamps are improved. Constant height lighting is also improved. Static variations were corrected with a headlamp adjusting device which could be operated from the dashboard by the driver of the vehicle. Dynamic levellers which ensure the correct setting of the lamp are also in use.

6700 APTIC NUMBER 16622

Backer, H. J., J. Strating, and L. H. H. Huisman
ADDITION OF SULFUR DIOXIDE TO DI-CYCLOHEXENYL-1.1'. FORMATION OF DERIVATIVES OF DIBENZOTHIOPHENESULFONE. (Addition d'anhydride sulfureux au di-cyclohexenyle-1.1'. Formation de derives de la dibenzothiophenesulfone). Text in French. Rec. Trav. Chim., vol. 60:381-390, 1941. 8 refs.

Reaction of sulfur dioxide to di-cyclohexenyl-1.1' (II) show that the two conjugate double bonds are in the two rings of six atoms each. II is obtained by dehydration of cyclohexanonepinacol (I), the preparing which has produced biproducts, one of which was identified as 1.3-dicyclohexylcyclohexanone-2. (Ib). Addition of SO2 to II yields a tricyclic sulfone (III), which gives, on hydrogenation, a saturated sulfone. Addition of Br to the latter yields a dibromide (IV). Ozonization of III yields a peroxide (Va), revealing III's structure. Reduction of Va by hydroiodic acid gives di-cyclohexanonylsulfone (Vb) which is a dicetone. To establish the structure of Vb, Na2S was reacted with alpha-chlorocyclohexanone, yielding dicyclohexanonyldisulfide and dicyclohexanonylsulfide (VI). Oxidation of VI by oxygenated water gives Vb. Treated with an alcoholic lixiviant of caustic K at ambient temperature, the dibromide IV loses two molecules of hydrobromic acid yielding, what appears to be most likely a sulfone with two double bonds (VIIa), the dibromide of which would be of the form (VIIb). Ozonization of VIIa gives adipic acid, but has not been definitely identified as such. This same acid is also formed by interaction of sulfuric acid with an as yet unidentified sulfonic acid. Partial hydrogenation of VIIa has not yielded any well-defined products. The product of its complete hydrogenization has already been described in a previous paper. For everyone of the compounds identified by a Roman

numeral, a description is given of its preparation, its melting point, and some of its other properties.

6701 APTIC NUMBER 16626

Backer, H. J. and J. Strating
CYCLIC SULFONES DERIVED FROM BUTADIENES. (Sulfones cycliques, derivees de butadienes). Text in French. Rec. Trav. Chim., vol. 53:525-543, 1934. 21 refs.

Addition of sulfur dioxide to butadienes gives rise to cyclic sulfones which possess a double bond which, in most cases, fixes Cl or Br atoms. On the other hand, sulfones whose double bond carries one or two groups of tert.butyl or two groups of phenyl resist the Br addition (steric hindrance). 2,3-dimethylbutadiene sulfone forms a dibromide, which yields a diol (trans) on hydrolysis. Direct oxidation of this sulfone by permanganate gives rise to the stereomer diol (cis). The dibromide, losing two molecules of hydrobromic acid leaves a weakly stable thiophenesulfone. An acetic solution of Cl reacting with dimethylbutadienesulfone fixes in it acetyl hypochlorite. The same type of addition-reaction could be carried out with the ethylene. The homologs of isoprenesulfone isomerize on exposure to ultraviolet radiation. The method of preparation and of some properties are presented, such as temperature of melting and/or boiling point, color, crystal habit, and, in the case of trans- and cis- isomers of 3,4-dihydroxy-3,4-dimethyl-thiacyclopentane-1.1-dioxide only, the crystal structure. The 37-odd organic compounds studied by the authors are identified by their chemical designation and, in 25 cases, by their structual formulas as well and are ordered according to the 8 specific butadienes from which they were derived.

6702 APTIC NUMBER 13499

Bagliano, G. and L. Ossicini
THE ADSORPTION OF METAL IONS FROM HF-HC104 MIXTURES ON SOME ION EXCHANGE PAPERS. J. Chromatog., 21(3):499-502, March 1966. 2 refs.

A comparison of ion exchange from HF-HCl and HF-HC104 mixtures for ions known to adsorb from these solutions is made using two types of anion and one cation exchange paper. The concentration of HCl or HC104 was maintained constant at 1N and the HF concentration was varied from 1 to 10%. Experimental results show that, while there are considerable differences in adsorption from HF-HCl, very few ions were adsorbed from HF-HC104. Tantalum may be adsorbed from mixtures with Hf, Zr, Ti, Nb, Mo, W, and U on an anion exchange resin paper from HF-HC104.

6703 APTIC NUMBER 16172

Balazs, E. A., J. V. Davies, G. O. Phillips, and M. D. Young
TRANSIENT INTERMEDIATES IN THE RADIOLYSIS OF HYALURONIC ACID. Radiation Res., 31(2):243-255, 1967. 32 refs.

By means of electron paramagnetic resonance (EPR) after gamma irradiation in the solid state, hyaluronic acid, glucuronic acid, and N-acetylglucosamine have 3.7, 2.6, and 3.8 G radicals respectively. The EPR spectrum of hyaluronic acid consists essentially of a singlet with a line width of about 20 gauss and a (g) value of 2.00124. However, at low doses, the spectrum shows a hyper-fine structure doublet with a splitting of 4-5 gauss. A well-defined doublet with a splitting of 4-5 gauss is evident in the N-acetylglucosamine spectrum, but the glucuronic acid spectrum gives only a singlet that cannot be further resolved. The intermediates satisfactorily account for the observed chemical degradation and EPR data. Pulse radiolysis with 4-MeV electrons of aqueous solutions of hyaluronic acid show that aminopolysaccarides react rapidly with both solvated electron and OH radicals. The reaction rates for both processes are evaluated. Gamma irradiation of hyaluronic acid in the solid state and comparison with gamma-irradiated solid glucuronic acid and N-acetylglucosamine indicate that both glycosidic cleavage and attack of the C-5 hydrogen in the pyranose ring may occur to give the transient free radicals observed.

6704 APTIC NUMBER 16416

Barchewitz, Pierre, Lucien Dorbec, Alain Truffert, and Philippe Vautier
CONTINUOUS LASER EMISSION BY DIRECT HIGH-FREQUENCY EXCITATION OF CO2 AND N2O IN THE VIBRATIONAL TRANSITIONS 00(ZERO-TH ANGULAR MOMENTUM STATE)1 - 10(ZERO-TH ANGULAR MOMENTUM STATE)0 AND 00 (ZERO-TH ANGULAR MOMENTUM STATE)1 - 02(ZERO-TH ANGULAR MOMENTUM STATE)0. (Emission laser continue par excitation haute frequence directe de CO2 et N2O dans les transitions vibrationnelles 00(etat moment angulaire zero)1 - 10(etat moment angulaire zero)0 et 00(etat moment angulaire zero)1 - 02 (etat moment angulaire zero) 0). Text in French. Compt. Rend., 260(21):5491-5493, May 24, 1965. 6 refs.

A previously described experimental laser with its high-frequency power raised to about 100 watts enabled the authors to obtain laser output power in excess of 2 watts by using mixtures of either CO2 or N2O with nitrogen or air. In addition to the previously observed spectral lines P(12) to P(30), the authors identified in the laser emissions of CO2 a number of R-branch lines, R(11) to R(27) of the 00(zero-th angular momentum state)1 - 10(zero-th angular momentum state)0 transition, centered around 975 reciprocal cm, by using the CO2 absorption spectrum at 10 microns. After a special adjustment of the resonant cavity, the authors were able to observe, simultaneously with the above, a set of less intense P-branch lines: P(14) to P(28) of the 00(zero-th angular momentum state)1 - 02 (zero-th angular momentum state)0 vibrational transition, centered around 1045 reciprocal cm (945 reciprocal cm according to the illustration). Using the same experimental setup, the authors identified in the laser emission of N2O, in addition to the previously reported P-brance lines P(14) to P(24), the R-branch lines R(11) to R(23) of the 00(zero-th angular momentum state)1 - 10(zero-th angular momentum state)0 transition centered around 955 reciprocal cm, by using given rotational constants of N2O.

6705 APTIC NUMBER 16487

Barrer, R. M.
SURFACE FLOW OF ADSORBED GASES AND VAPOURS. Proc. Brit. Ceram. Soc., no. (5):21-38, Dec. 1965. 26 refs.

Evidence of surface mobility of chemisorbed films by thermionic and photoelectric emission was obtained some time ago; more numerous and more recent are studies of surface flows of physically adsorbed gases and vapors in microporous, high-area ceramic-type materials (including Vycor porous glass, compacted nonporous and porous carbon blacks, compressed alumina-silica cracking catalysts, or Linde silica plugs). A review is given of the measurement and interpretation of surface fluxes in a number of these media, and of the importance of such studies in the field of physical adsorption. It is shown that surface flow in high-area fine-pored compacts can readily be studied for gases and vapors. The surface transport can be interpreted in terms of surface diffusion coefficients which are functions of temperature, and, for denser films, of the amount sorbed. The surface flow can be related to the adsorption properties of the diffusion gases and to the texture of the porous medium. (Author abstract modified)

6706 APTIC NUMBER 16593

Barrer, R. M.
SURFACE FLOW AND MIXTURE SEPARATION IN MICRO-POROUS MEDIA. Inst. Chem. Eng. Symp. Ser. (London), no. 1:112-121, 1965. 24 refs.

Some properties of surface flow involving dilute adsorbed films in or near the Henry's law range of adsorption and also involving denser adsorbed films approaching and exceeding monolayer coverage were described. The media studied were porous glass, carbon plugs, and alumina-silica catalyst plugs. Even in the Henry's law range in the highest area microporous carbon membrane, surface flow exceeded gas-phase flow. For dense adsorbed films, surface flow could greatly exceed, and also block, gas-phase flow. Among separations studied were those involving the binary mixtures, H2 + SO2, He + CO2, H2 + CO2, and H2 + Ar. In the temperature range -20.7 to -33 C, for the pair of gases (H2 + SO2) having the greatest difference in boiling point, a carbon membrane behaved as an almost perfect molecular sieve in transmitting sulfur dioxide only at higher relative pressures of this gas. At -83 C, large enrichment factors in a single stage were obtained also for carbon dioxide in He + CO2 and H2 + CO2, and at -195 C, a useful enrichment of argon in H2 + Ar was also observed. Separations were often in the direction opposite from those associated with effusion alone. Mathematical consideration was also given to the enhanced separations obtained in the early transient state of flow. It was concluded that the permeabilities of the media to diffusing species may be very high compared with those of homogeneous polymeric membranes. Thus there seems good reason to develop micro-porous, high-area septa for the resolution of mixtures of gases, vapors, and liquids in both single-stage and multi-stage systems. (Author abstract modified)

6707 APTIC NUMBER 16169

Baume, Georges
FREEZING POINT OF GASEOUS MIXTURES AT VERY LOW TEMPERATURES. (Sur le point de congelation des melanges gazeux a de tres basses temperatures). Text in French. Compt. Rend. 148:1322-24, 1909. 6 refs.

The gas mixtures studied were (CH3)2O-HCl, (CH3)2O-SO2 and (CH3)2O-CH3Cl. The freezing point curve of the first and 2 maxima, one at -94 C, the other at -102, corresponding to a mixture of one ether and 4 HCl. Solid ether + SO2 was obtained; temperatures were not given.

6708 APTIC NUMBER 13448

Beattie, I. R. and S. W. Bell
DINITROGEN TRIOXIDE. I. STABILITY IN THE GASEOUS PHASE. J. Chem. Soc., p. 1681-1686, 1957. 9 refs.

By means of an all-glass apparatus, where all possible greases either reacted with or absorbed nitrogen oxides, the equilibrium between nitrogen dioxide, dinitrogen tetroxide, nitric oxide, and dinitrogen trioxide was studied in the gas phase at 5, 15, 25, 35, and 45 deg. The equilibrium constant at each temperature was determined over a wide concentration range, so thermodynamic constants can be obtained by extrapolation to zero pressure. Variations occurring in k2 were attributed to non-ideality of the gases, sorption, or variations in k1. Extrapolated values of k2 at various temperatures, obtained by the least squares method, yielded a value of 9527 plus or minus 96 cal/mole for the heat of reaction. The corresponding entropy change for the reaction was 33.25 plus or minus 0.35 cal/mole/deg.

6709 APTIC NUMBER 13449

Berg, Lloyd and William Bruce Isaacson
HYDRODESULFURIZATION OF CRUDE ALPHA-PINENE. U. S. Pat. 3,312,750. 3p., April 4, 1967. 4 refs. (Appl. Oct. 21, 1963, 2 claims.)

A process for removing sulfur compounds from crude alpha-pinene by means of catalytic hydrogenation is proposed. This hydrogenation process will selectively convert the sulfur compounds in crude alpha-pinene to hydrogen sulfide while not appreciably affecting the unsaturated character of the alpha-pinene. A suitable catalyst is proposed for the reaction. In this invention the crude alpha-pinene and gaseous hydrogen are passed over a cobalt molybdate catalyst. The preferred catalyst consists of 1/8 in to 3/16 in pellets of alumina containing 3% cobalt oxide and 15% molybdenum oxide.

6710 APTIC NUMBER 16373

Bergman, A. G. and N. A. Shul'ga
REACTION OF UREA WITH LITHIUM, SODIUM, POTASSIUM AND BARIUM

NITRATES. (Vzaimodeystviye mocheviny s nitratami litiya, natriya, kaliya i bariya). Text in Russian. Zh. Neorgan. Khim., 9(5): 1218-1220, 1964. 3 refs.

Binary and ternary systems were studied by the visual-polythermal method at temperatures up to 160-170 C. The binary system CO(NH2)2-Ba(NO3)2 showed a eutectic at 96 C with 10.5% Ba(NO3)2. Accessible portions of the following ternary systems were also studied: LiNO3-CO(NH2)2-Ba(NO3)2, NaNO3-CO(NH2)2-Ba(NO3)2, and KNO3-CO(NH2)2-Ba(NO3)2. The following eutectics were established for the indicated percent concentration of nitrate: CO(NH2)2-LiNO3: 76 C, 16.5; CO(NH2)2-NaNO3: 84 C, 23.0; CO(NH2)2-KNO3: 110 C, 16.0; CO(NH2)2-Ba(NO3)2: 96 C, 10.5; CO(NH2)2-NH4NO3: 46 C, 46.5.

6711 APTIC NUMBER 16295

Bergman, A. G. and K. Nogoyev
SYSTEMS OF CO(NH2)2-LINO3; (LI, NA, K)NO3 AND (NA, K, NH4)NO3. (Sistemy CO(NH2)2-LiNO3; (Li, Na, K)NO3 i (Na, K, NH4)NO3). Text in Russian. Zh. Neorgan. Khim., 9(6):1423-1426, 1964. 8 refs.

A visual-polythermal method was used to study the binary system of urea-lithium nitrate, and the ternary systems of lithium, sodium, and potassium nitrates, and sodium, potassium, and ammonium nitrates. For CO(NH2)2-LiNO3, eutectics were found at 95 C and 76 C with urea in amounts of 45.5 and 83.5 mole %, respectively. A discontinuity of the feasibility curve was observed in the lithium nitrate branch at 186 C and 35 mole % urea. A ternary eutectic point was established at 120 C with 37.5 mole % LiNO3, 18 mole % NaNO3, and 44.5 mole % KNO3. The ternary eutectic point for the third system was found at 115 C with 74.5 mole % NH4NO3, 7.5 mole % KNO3, and 18 mole % NaNO3. The ternary transition point at which alpha- and beta-NH4NO3 and 2NH4NO3-KNO3 are found at the surface occurs at 125 C with 80 mole % NH4NO3, 7 mole % KNO3, and 13 mole % NaNO3.

6712 APTIC NUMBER 16596

Bieler, G.
THE PRESENT STATE OF KNOWLEDGE OF THE VISCOSITY OF FUSED MASSES: GLASSES, GLAZES, ENAMELS, SCORIAE. (Etat actuel des connaissances sur la viscosite des masses fondues: verres, glacures, emaux, scories). Text in French. Ind. Ceram., no. 505:43-49, 1959. 39 refs.

Thirty-three of the 39 papers in this review contain information regarding the viscosity of fused ceramic masses, covering the aspects of theory; apparatus and measurement of viscosity; experimental studies of glasses, enamels, and glazes; studies of ceramic systems; experimental studies of scoriae and slags; and relations between viscosity and chemical reactivity refractories. Seven of the papers deal with methods of testing the corrosion resistance of ceramic materials.

6713 APTIC NUMBER 16323

Biermann, P. and D. Vortmeyer
RADIATION OF GASES CONTAINING DUST PARTICLES. (Waermestrahlung staubhaltiger gase). Text in German. Waerme Stoffuebertragung, 2(4):193-202, Dec. 1969. 15 refs.

After a presentation of a qualitative survey on the absorption and scattering of small particles, it was shown that in the range of small optical thicknesses, expressions for the emissivity of dust clouds were analogous to those of gases. Measurements confirmed this. The emissivities of 20 different dust materials were measured and interpreted. For calculations with unknown materials, average emissivity data were recommended. (Author abstract modified)

6714 APTIC NUMBER 16402

Bilenko, A. P.
METHOD OF DESIGNING FILTER CLOTH OF CHEMICAL FIBERS. (Pro metodiku proyektuvannya fil'truval'nikh tkanin z khimichnikh volokon). Text in Ukrainian. Lehka Promysl., 8(1):17-19, Jan-Feb 1967.

Work carried out at the Research Institute for the Development of Artificial and Synthetic Fibers is reported. The design of suitable weaves for mechanical, disk impurity-concentrating, and barrel vacuum filters is discussed. Formulas are given for the ratio of warp density to weft density, porosity, and thread volume for a given porosity. Physical and mechanical characteristics of three cloth types are given. Specific application to the sugar industry is indicated.

6715 APTIC NUMBER 16027

Blakeway, John Murray and Philip Marshall
SULPHONATION OF ORGANIC COMPOUNDS. (Colgate Palmolive Co., New York) U. S. Pat. 3,346,505. 4p., Oct. 10, 1967. (Appl. March 15, 1963, 5 claims).

An invention describes the co-sulfonation of sulfonatable organic compounds of different volatilities with sulfur trioxide diluted with an inert gas. Problems arise if the organic compounds are of substantially different volatilities, for such as those which when sulfonated and neutralized are useful as active ingredients in detergent compositions. A high molecular weight alkyl benzene and the diluted sulfur trioxide are introduced in the reaction zone. The more volatile component, a low molecular weight alkyl benzene, and additional diluted sulfur trioxide are added to the reaction zone only after sulfonation of the less volatile component is substantially completed. The point at which the more volatile component is added is not critical. But the earlier this is begun, the greater the risk of losing the more volatile component with the inert gas. The more volatile component is usually introduced when 50% of the less volatile component is sulfonated. The extent of sulfonation is calculated from the amounts of the low molecular weight alkyl benzene and the sulfur trioxide. This invention can be applied to any suitable

sulfonating process in which the sulfonating agent is diluted with sulfur trioxide.

6716 APTIC NUMBER 15975

Blickle, Tibor, Janos de Jonge, Ferenczy Zoltan, and Pal Kaldi
THE OXIDATION OF SULFUR DIOXIDE WITH FLUIDIZED IRON OXIDE CATALYZER. (Kendioxid oxidalasa fluidizalt vasoxid-katalizatorral). Text in Hungarian. Veszpremi Vegyi. Egyet. Kozle., vol. 5:109-120, Feb. 1962. 3 refs.

Theoretical and experimental investigations were conducted on the decrease in the rate of sulfidation of iron oxide under fluidization conditions in excess of 500 C. It was found previously that the fluidized iron oxide is a better catalyzer than vanadium pentoxide because (1) higher rates of reaction can be achieved in the sulfur dioxide oxidation process, (2) the iron oxide is less susceptible to catalyst-poisoning, and (3) iron oxide is more resistant to mechanical wear. The main drawback of iron oxide is that at its temperature limit of 620 C, where only 67.9% sulfur dioxide conversion takes place, the sulfidation of the iron oxide itself is very strong. The investigations show that even a slight amount of fluidization will prevent the sulfidation of the iron oxide. In the tests, the catalyzer was kept to 0.45 mm size, the gas flow contained 7% sulfur dioxide, 18.6% oxygen and 74.4% nitrogen at 450, 500, 550 and 600 C. The experimental reactor was a 3.8-cm diameter, chamotte cylinder surrounded by an electrical resistance heated oven. The paper defines the amount of fluidization by stating that the 0.45 mm catalyst particles were 'strongly' 'slightly' or 'not at all' fluidized. Regeneration of the iron oxide catalyst was also investigated in the fluidized-bed reactor; equations are given for calculating the time needed for regeneration of the catalyst. A theoretical equation derived for the nonfluidized catalyzer was found to be valid for the fluidized bed as well. The maximum amount of conversion was 90%.

6717 APTIC NUMBER 16262

Blyholder, George and Laurence D. Neff
INFRARED SPECTRA OF CO, CO2, O2, AND H2O ADSORBED ON SILICA-SUPPORTED IRON. J. Phys. Chem., 66(8):1464-1469, Aug. 1962. 7 refs.

The spectra of gases chemisorbed on iron were investigated for a knowledge of the nature of iron as a chemisorber and as a catalyst. Infrared spectra at 20 and 180 deg were obtained for carbon monoxide, carbon dioxide, oxygen, and water adsorbed on silica supported iron. Chemisorbed CO and gas phase CO are in dynamic equilibrium at 180 deg. Chemisorbed CO gives bands at 4.95, 5.05, and 5.3 micron. CO2 dissociates into chemisorbed CO and an oxide ion when adsorbed at 20 deg. Both O2 and H2O displace chemisorbed CO from the surface, but do not give any bands themselves. At 180 deg, adsorbed O2 has a spectrum characteristic of iron oxide. At 180 deg, adsorbed water apparently completely dissociates, since it gives no OH band. While CO2 gives no evidence of physical adsorption at 20 and 180 deg, it gives a band at 4.3 micron which is tentatively assigned as physically adsorbed CO2. CO2 or a mixture of CO and O2, when heated to 180 deg, gives a surface complex with a 6.5 micron band. This complex is tentatively designated as a carboxylate type structure. (Author abstract modified)

6718 APTIC NUMBER 15971

Bobrov, L. I.
FIBROUS HEAT-RESISTANT MATERIALS. In: Kritika i Bibliografiya. Translated from Russian. Foreign Technology Div., Wright Patterson AFB, Ohio, Translation Div. FTD-MT-24-25-69, 1968 (7), p. 71-74. 64 refs.
CFSTI: AD 691871

Heat-resistant fibers and fabrics are used as reinforcement materials for plastic laminates, as thermal insulation materials, and for the filtration of corrosive gases and liquids at high temperatures. Methods of obtaining metallic, ceramic, carbon, impregnated synthetic, and organically coated fibers are reviewed, and the properties of the fibers compared. New developments in the technology of metallic fibers include chemical etching of wires, direct molding of threads of uniform diameter, and the introduction of finely pulverized metallic powders into a spinning solution or polymer melt. Ceramic filters are obtained by dissolving refractory oxides into polymers and subsequent heat treatment. Fibrous carbon-graphite fibers with high physical and mechanical properties are obtained by the thermochemical decomposition of cellulose and polyacrylonitrile fabrics. One of the basic deficiencies of fibrous carbon materials is their relatively low oxidation temperature and weak resistance to abrasion. These disadvantages are overcome by the gas-phase deposition on the filters of thin films of different organic substances and compounds.

6719 APTIC NUMBER 16297

Booth, Michael
ELECTRIC CAR DEVELOPMENT. Automotive Design Eng., vol 7:44-45, Dec. 1968. 5 refs.

The energy source, control gear, and drive motor of an electric car are discussed. The power storage system is the biggest obstacle to commercial exploitation of the electric car. The absence of a high capacity battery imposes restrictions on electric car development. With the present lead acid battery, a range of 20 miles in urban conditions and 40 miles at steady speed can be achieved. The choice of a control system is complicated by cost. The simplest and cheapest system uses a carbon pile regulator circuit in series with batteries and motors. It has the disadvantage on being wasteful on power. The thyristor is a solid state switch which pulses the dc current from the batteries. By varying the on/off ratio of these pulses, the actual applied voltage and current are varied, giving smooth acceleration of the motor. The system is costly. A third method of speed control is to selectively scan the batteries, in order to give a variable current and voltage with the advantage that a provision can be incorporated to spread the load across all the cells. Critical points in motor selection arise through high operating temperatures, high quality insulation, stresses on windings due to over-speeding while the vehicle coasts, and high brush loadings required to eliminate the possibility of brush bounce.

Possibilities for the design of motors specifically for the job are as follows: motors built in the road vehicle; thyristor-assisted commutation; brushless motors with complete thyristor commutation; homopolar dc motors; and induction motors fed from an ac inverter. Future marketing prospects ary in the zinc-air battery and the attractions of the electric car to older people, as a shopping vehicle, and in public service.

6720 APTIC NUMBER 16480

Boreskov, G. K., L. G. Bimmer, and F. I. Volkova
IGNITION TEMPERATURE OF VANADIUM SULFURIC ACID CATALYSTS. (Temperatura zazhiganiya vanadievykh sernokislotnykh katalizatorov). Text in Russian. Zh. Prikl. Khim., 13(3):250-260, 1949. 7 refs.

A thermographic method of determining the ignition temperature of the catalytic mass was developed and verified. The ignition temperature of sulfuric acid-vanadium catalysts was experimentally determined for gas mixtures containing from 7-95% sulfur dioxide and 5-75% oxygen at initial degrees of catalysis of 0 to 50%. It was shown that a change in the ignition temperature of vanadium catalysts in relation to the composition of the gas was dependent on the shift of the temperature of the phase transformation of the catalytically active polyvanadates into vanadyl sulfates and with a change in the reaction rate. Equations are proposed and a diagram constructed for determining of the ignition temperature of gas mixtures of varying composition. At a constant concentration of oxygen, the ignition temperature was practically independent of the sulfur dioxide concentration. With an increase in oxygen concentration, the ignition temperature decreased. For gas obtained by roasting pyrites and containing 7% sulfur dioxide and 11% oxygen, the ignition temperature was 423 C. For a stoichiometric mixture (66.7% sulfur dioxide, 33.3% oxygen), the ignition temperature equalled 394 C. An increase in the degree of catalysis to 50% increased the ignition temperature 20-30 deg. A decrease in the activity of the vanadium catalysts as a result of terminal treatment or lengthy processing increased the ignition temperature which was directly proportional to the logarithm of the ratio of thyinitial and final values of the reaction rate constant. The temperature of extinction was determined for gas mixtures containing 7% sulfur dioxide; 11% oxygen and 50% sulfur dioxide; and 50% oxygen. At a hypothetical linear gas flow rate equal to 0.15 m/sec, the temperature of extinction in the first case was 7 deg and in the second, 85 deg below the temperature of ignition. The difference in the temperatures of ignition and extinction corresponded well with the difference in surface temperature of the grains in the first layer of catalyst and gas, calculated according to the rate of heat loss. This indicates that catalytic oxidation of sulfur dioxide is carried out entirely at the surface of the catalyst.

6721 APTIC NUMBER 15822

Boreskov, G. K., M. A. Buyanov, and A. A. Ivanov
KINETICS OF SULFUR DIOXIDE OXIDATION ON VANADIUM CATALYSTS. (Issledovaniye kinetiki okisleniya dvuokisi sery na vanadiyevykh katalizatorakh). Text in Russian. Kinetika i Kataliz, 8(1):153-159, 1967. 24 refs.

The kinetics of oxidation of sulfur dioxide over a vanadium catalyst at 485 C was studied experimentally using the flow-circulation method. The applicability of well-known kinetic equations was verified and deviations from them determined. The catalyst contained 8.5% V2O5, and catalyst grain size was 0.25-0.5 and 0.5-1.0 mm. An equation was presented which satisfactorily describes the kinetics of SO2 oxidation under the conditions studied. It is assumed that the limiting stage is the absorption of oxygen, which is dependent upon the degree of reduction of the catalyst. This, in turn, depends upon the ratio of SO2 to SO3. An approximate expression for this dependence was given.

6722 APTIC NUMBER 16461

Boreskov, G. K. and T. I. Sokolova
KINETICS OF CONTACT OXIDATION OF SULFUR DIOXIDE ON FERRIC OXIDE. (Kinetika kontaktnogo okisleniya sernistogo gaza na okisi zheleza). Text in Russian. Zh. Fiz. Khim., 18(3-4):87-101, 1944. 19 refs.

The effect of temperature on the rate of catalytic oxidation of SO2 on ferric oxide and on the change in catalyst composition was studied experimentally. It was established that a sharp decrease in catalytic activity observed at 620-640 C is conditioned by conversion of ferric oxide (hematite) to catalytically inactive ferric sulfate. Ferrous-ferric and ferrous sulfates were not detected in the catalyst after low temperature operation. The kinetics of SO2 oxidation over Fe2O3 were studied at 680 C. Above 625 C (i.e., above the range of hematite stability), the apparent activation energy of the forward reaction is 38,000 cal. A proposed mechanism for Fe2O3 catalysis of SO2 which assumes an intermediate reaction of SO2 with the surface of the catalyst, without disruption of the bond between surface iron atoms and the rest of the hematite crystal lattice, is presented. It is suggested that the surface of the hematite crystals combines with oxygen and that the limiting stage of the catalytic reaction is the absorption of oxygen from the gaseous phase.

6723 APTIC NUMBER 16568

Borucka, Alina
ELECTROCHEMICAL BEHAVIOUR OF THE CO/CO2 GAS ELECTRODE IN MOLTEN ALKALI CARBONATES. I. EXPERIMENTAL TECHNIQUE AND THERMODYNAMIC RESULTS. Electrochim. Acta, 13(3):295-307, March 1968. 13 refs.

The thermodynamic behavior of the CO/CO2/Au electrode in molten alkali carbonate electrolyte was studied in a specially designed gas-tight apparatus. At temperatures of 700-800 C, the equilibrium potential of the electrode was found to be determined by the overall reaction CO plus CO3(2-) in equilibrium with 2CO2 plus 2 electrons, and to obey the Nernst equation accurately over the whole range of gas compositions. A new CO/CO2/Au gas reference electrode was developed, and its zero potential defined by the condition (the partial pressure of CO2 squared/partial pressure of CO) equal to 1 atm. In relation to the new reference electrode, a new potential scale for molten carbonate electrolytes was proposed. The implications of the Boudouard equilibrium were considered in relation to the CO/CO2 electrode, and a concept of

the Equivalent Boudouard potential was suggested. A convenient alignment chart was constructed which directly correlated all the relevant variables to the CO/CO2 potential expressed on the new standard scale. (Author abstract modified)

6724

APTIC NUMBER 15877

Broussalian, George L.
COMPLEXES OF SO3 WITH NITRILES, METHOD OF PREPARATION THEREOF AND METHOD OF SULFONATION OF SULFATION THEREWITH. (Monsanto Co., St. Louis, Mo.) U. S. Pat. 3,287,389. 4p., Nov. 22, 1966. 10 refs. (Appl. Sept. 14, 1962, 18 claims).

Methods are described for preparing and utilizing complexes of SO3 with either organic cyanide (or nitrile) compounds or hydrocyanid acid and its halide derivatives. These compositions are advantageously utilized in processes involving the sulfonation and sulfation of organic compounds with SO3. The processes involve contacting the organic material with the complex at very low temperatures. In the sulfur trioxide nitrile complex, the nitrile serves as the sulfur tricxide carrier and sulfur trioxide can be recovered at temperatures below -5 C in chemically unmodified form. The nitrile belongs to a group which is attached to a hydrocarbon radical containing 1-15 carbon atoms. The hydrocarbon radical is selected from a group consisting of saturated and monoethylenically unsaturated aliphatic radicals, alicyclic radicals, monocyclic aryl radicals, and aralkyl radicals. The complex is formed by contacting the nitrile compound with sulfur trioxide at -15 C. All that is required for sulfonation or sulfation is that the SO3 complex be brought in contact with the reacting material while the material is in the fluid state and at temperature below -5 C, and preferably below -15 C. If efficient cooling and mixing are maintained, the material can be intermingled with the complex in any preparation desired. Suitable solvents for the sulfonation and sulfation processes include those that are fluid at low temperatures and inert to SO3 at low temperatures. Typical solvents are carbon tetrachloride, chloroform, bromoform, methylene choride, methylene, bromide, and ethyl ether, among the applications of the invention are the preparation of foaming agents, surface active agents, and detergents.

6725

APTIC NUMBER 16199

Budkevich, G. B., I. B. Slinyakova, and I. Ye. Neymark
METHOD OF PREPARATION OF METALLIZED SILICA GELS. (Sposob polucheniya metallizirovannykh silikageley). Text in Russian. (Pisarzhevskiy (L. V.) Inst. of Physical Chemistry, USSR) U.S.S.R. Pat. 218,831. 1p., May 30, 1968. (Appl. Nov. 17, 1965, 1 claim).

The invention concerns a method of preparing metallized silica gels using the hydrogenous silica gel, hydridepolysiloxane xerogel, as the starting material. The hydridepolysiloxane xerogel is treated with the aqueous solution of metal salts at room temperature and their reduction to metals is the result of hydrolysis of the Si-H bonds and of evolution of atomic hydrogen. Metallized silica gels prepared by the proposed method contain between 30 and 50% of metal in the form of a uniform and finely dispersed surface coating. For example, 0.25 to 0.5 mm diameter grains of hydrophobic hydridepolysiloxane xerogel are, first, steeped with acetone to facilitate their wetting, and then soaked for 24 hours at room temperature in a 0.5 normal aqueous solution of one of the following salts: palladius chloride, copper nitrate, mercury nitrate, or silver nitrate. After this treatment, the solution is poured off. The sample is thoroughly washed with distilled water and dried in a desiccator for 6 hours at 200 C.

6726

APTIC NUMBER 16218

Buff, H. and A. W. Hofmann
DISSOCIATION OF GASEOUS COMPOUNDS BY ELECTRICALLY INDUCED GLOWING. (Zerlegung gasfoermiger Verbindungen durch electrisches Gluehen). Text in German. Ann. Chem. Pharm., 113(2):129-150, 1860. 4 refs.

Gases and vapors of liquids with low boiling points were exposed to powerful sparking as produced by the Ruhmkoff induction coil, to glowing platinum and iron wires, and to the high temperature of the flame arc, and the dissociation was observed. The induction coil is best suited for dissociation of ammonia; all the other methods take too long. Dissociation of C2H5N begins immediately, but it is never complete. Dissociation of C6H9N and of C4H7N is slow and incomplete. Iron wires dissociated C2N completely but slowly; the flame arc is much faster. The induction coil is least suitable. Nitric oxide is dissociated rapidly by a glowing iron spiral and by the flame arc, and slowly by the induction coil. The dissociation is not complete. Similar results are obtained with NO2. None of the methods work with dry CO. Reduction of CO2 is slow with both the flame arc and the induction coil. The dissociation of CS2, C2H4, C4H4, SO2, HS, PH3, ClH and SiF12 was observed in like manner, and the efficiency of each method was stated.

6727

APTIC NUMBER 16391

Bullrich, K., H. Eiden, G. Eschelbach, K. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
COMPUTATION OF MULTIPLE SCATTERING IF THE TURBID ATMOSPHERE. In: Research on Atmospheric Optical Radiation Transmission. Dec. 1, 1967 - Nov. 30, 1968. (Final Report.) Johannes Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie, OAR Contract F 61052 67 C 0046, AFCRL-69-0-0266, p. 54-81,108-111, Jan. 1969. 38 refs.

A method is given for the approximate calculation of multiple scattering in the turbid atmosphere using the equation of radioactive transfer, the atmosphere being divided in different layers of certain optical depths. Because of the large computer memory required for the solution of the matrix equation, the single step method of Gauss-Seidel is used in combination with the Jacobi iteration procedure. To obtain exact results of the intensities, it is necessary to solve the radiative transfer equation for all four Stokes' parameters. (Author abstract modified)

6728 APTIC NUMBER 15959

Burg, Anton B.
THE BEHAVIOR OF TRIMETHYLAMINE, TRIMETHYLAMMINO-SULFUR TRIOXIDE AND TRIMETHYLAMINE OXIDE TOWARD SULFUR DIOXIDE. J. Am. Chem. Soc., vol. 65:1629-1635, Aug. 1943. 11 refs. (Presented at the American Chemical Society Meeting, Detroit, Sept. 1940.)

The behavior of trimethylamine, trimethylammino-sulfur trioxide, and trimethylamine oxide toward sulfur dioxide was studied by determining the vapor phase tensions of the products formed by the reaction of SO2, and the compounds and the solubilities of these products in liquid SO2. The resulting compounds were compared with regard to their ability to employ their unshared electrons for bonding the electron acceptor molecule. Sulfur dioxide reacted with trimethylamine to produce (CH3)3NSO3, (CH3)3NOSO2, (CH3)3NSO2, and (CH3)3N; with trimethylamine-sulfur trioxide to produce (CH3)3NSO3; and with trimethlamine oxide to produce (CH3)NOSO2 and (CH3)3NSO3. The order of increasing attraction for SO2 appeared to be (CH3)3NSO3, (CH3)NSO2, (CH3)2NOSO2, (CH3)3N, and (CH3)3NO. The inertness of (CH3)3NSO3 toward sulfur dioxide was explained by the assumption that the oxygen atoms of the SO3 are chiefly double-bonded to sulfur, retaining little electron-dative external bonding power. The compound (CH3)3NSO2 is formed simply by electron sharing between nitrogen and sulfur. The presumed difference between the compound and the more soluble (CH3)3NSO3 is the absence of one neutral oxygen atom. The attachment of SO2 to the very stable compound (CH3)3NOSO2 is the residual effect of the high external bonding power of the amine oxide oxygen atom.

6729 APTIC NUMBER 16198

Buyanov, R. A. and O. P. Krivoruchko
METHOD OF PREPARATION OF A CATALYST ON AN IRON HYDROXIDE BASE FOR LOW-TEMPERATURE CONVERSION OF ORTHO-HYDROGEN INTO PARA-HYDROGEN. (Sposob polucheniya Katalizatora na osnove gidrookisi zheleza dlya nizkotemperaturnoy Konversii orto-vodoroda v para-vodorood). Text in Russian. (Akad. Nauk SSSR, Novosibirsk, Inst. Kataliza) U.S.S.R. Pat. 218,130. 2p., May 17, 1968. (Appl. March 11, 1967, 2 claims).

The invention concerns a modification of the known method of preparation of an iron-hydroxide-based catalyst for low-temperature conversion of ortho-hydrogen into para-hydrogen by precipitation of the iron hydroxide from an aqueous 11 to 13 weight % solution of FeCl3 by gradual addition to it of an aqueous 5.5 to 6.5 weight % solution of NaOH at a temperature between 85 and 95 C and a hydrogen ion concentration of pH equals 8 to 10. This is followed by cooling, washing out of Na(+) and Cl(-1) ions, drying, comminution, and activation in vacuo at a temperature of about 225 C. In the proposed modified method of preparation, the iron hydroxide is precipitated by simultaneous addition of equinormal aqueous 0.5N to 1N solutions of an iron salt, such as FeCl3, and a base, such as NaOH, to distilled water serving as a buffer solution whose hydrogen ion concentration is maintained at pH equals 7 to 8 by appropriate additions of aqueous solutions of HCl or NaOH, at a temperature between 20 and 25 C. This followed by washing out of Na(+) and Cl(-) ions, drying, comminution, and activation in streaming air, or in vacuo, at a temperature between 100 and 150 C. The internal specific surface of the resulting catalysts is 300 sq m/g and their catalytic activity is high. A detailed description of the preparation of a catalyst by the modified method is included by way of a specific example.

6730 APTIC NUMBER 16283

Calder, Kenneth L.
CURRENT URBAN POLLUTION MODELS. Preprint, North Carolina Univ., Chapel Hill, 19p., 1969. 21 refs. (Presented at the Symposium on Multiple Source Urban Diffusion Models, Chapel Hill, N. C., Oct. 27-30, 1969.)

The basic structure of many current urban pollution models is examined from the point of view of underlying assumptions and physical basis. The extension of steady-state models to variable conditions and long-term predictions is indicated, with a brief discussion of stochastic simulation of the concentration patterns and average seasonal and annual distributions. In view of the complexity of most computer oriented models, a sensitivity analysis is recommended to identify the input parameters that most critically affect the concentration predictions. Such an analysis would shed light on the detail and degree of accuracy that are necessary for an urban pollution emission inventory and on the accuracy required in specifications of the concentration field corresponding to a single source. (Author abstract modified)

6731 APTIC NUMBER 16488

Cantwell, Allan M. and Donald J. Morton
A SIMPLIFIED ENVIRONMENTALLY-CONTROLLED PLANT FUMIGATION CHAMBER EMPLOYING DYNAMIC EQUILIBRIUM PRINCIPLES. Preprint, Delaware Univ., Newark, Dept. of Plant Pathology, 5p., 1966 (?). 2 refs.

A simple fumigation chamber based on dynamic-equilibrium principles effectively controls temperature, relative humidity, and pollutant levels in plant fumigation studies. A 30-cu ft growth chamber capable of controlling temperature and day length was modified to control relative humidity by means of a spray nozzle and humidistat. A high pressure blower was installed in an inlet duct followed in sequence by a set of activated charcoal filters, an inlet to introduce a gaseous oxidizing agent to neutralize reductants not removed by the first filters, and a second set of filters. Conditioned air in the growth chamber is mixed with a gaseous pollutant, passed through a turbulence-inducing diffusion plate and distribution tube to the fumigation chamber, and is finally vented to the atmosphere. The system has a high degree of reliability and needs little attention after stabilization, which requires two hours. After this initial period, substantial changes in pollutant concentrations can be stabilized within 10 to 15 minutes. The fumigation chamber was used to determine the effect of temperature on tobacco plants exposed to 10 and 20 pphm ozone. Results show that ozone damage in sensitive plants is inversely related to temperature, and not to humidity, which was maintained at a constant 80%.

6732 APTIC NUMBER 16393

Carter, J. W.
ADVANCES IN ADSORPTION PROCESSES. Brit. Chem. Eng., 9(4):232-238, April 1964. 64 refs.

The largest use of solid adsorbents is in fixed beds, and the main part of this review is devoted to recently published applications, design, and correlations referring to this aspect. Also discussed are the increasing uses of synthetic molecular sieves; developments in membrane separation processes using polymer film for organic liquid mixtures and palladium and silica for hydrogen purification; and factors limiting the application of mass transfer zone methods of calculating bed depth to molecular sieves with a Langmuir-type isotherm. (Author abstract modified)

6733 APTIC NUMBER 15986

Cassano, A. E., P. L. Silveston, and J. M. Smith
PHOTOCHEMICAL REACTION ENGINEERING. Ind. Eng. Chem., 59(1):18-38, 1967. 72 refs.

The state of the art of the design of photoreactors is reviewed and reactor design problems are mathematically defined. Complex rate equations are derived for chain kinetics, radiation energy conservation, wall reactions, radial gradients, wall deposits, and effects of wavelength distribution, all of which affect conversion in a reactor. It is emphasized that a rate equation for photochemical process rates cannot be formulated independently of transport processes. Rates for photokinetics must consider wavelength effects, reaction mechanisms, heterogeneous processes, diffusional effects, and correction for dark reactions. Both analytical and numerical solutions are proposed for design problems. The former can not be applied in cases where diffusion and dispersion effects are due to velocity and concentration profiles and complex kinetics. Analytical solutions can be obtained where only a single linear reaction is involved, with no wall reactions and a constant attenuation coefficient. If the radiation equation is linearized, a heterogeneous wall termination reaction can be included in the solution. For completely mixed reactions (without wall reactions) two-step reaction kinetics can be solved. Again, the radiation equation must be linearized. Numerical solutions of general equations may not be realistic because of limitations in machine computation and unavailability of numbers for parameters. However, a plug-flow model of isothermal, monochromatic conditions can be solved numerically with complex kinetics.

6734 APTIC NUMBER 15882

Chapman, S.
THE POSSIBILITY OF SEPARATING ISOTOPES. Phil. Mag., 38(223):182-186, 1919. 6 refs.

The mathematical theory of thermal diffusion was considered for the case of a gas mixture in which the molecular masses are nearly equal, as in a mixture of neon and metaneon. Equations were derived for estimating the separation power of thermal diffusion as compared to that of power diffusion and for calculating the time required for thermal diffusion in a cylinder. The theoretical results demonstrate the practicality of separating isotopes by thermal diffusion.

6735 APTIC NUMBER 16482

Cheh, Huk Yuk
ON THE MECHANISM OF ELECTROLYTIC GAS EVOLUTION. California Univ., Berkeley, Dept. of Chemical Engineering, Thesis (PhD), Ann Arbor, Mich., Univ. Microfilms, Inc., 1967, 108p., 74 refs.

A review of the various steps involved in the formation of a gas phase at an electrode-solution interface and of the mass transfer aspects associated with the overall process was presented. The analogies between electrolytic gas evolution and nucleate boiling were also discussed. Theoretical calculations on the dynamics of asymptotic bubble growth in an initially non-uniform concentration or temperature field were performed. For the case of electrolytic gas evolution, a significant simplification was achieved by noting that the Jakob number for mass transfer is usually small so that the convective transport can be neglected in comparison with the diffusive transport. Numerical solutions were obtained for the growth rate of a hemispherical bubble on an electrode surface with linear and exponential initial concentration fields of the electrolytically generated gas and also for the cases involving initial concentration fields resulting from the constant potential and constant current experiments. For the case of nucleate boiling, the parametric solution of Skinner and Bankoff using the thin thermal boundary layer approximation associated with the large Jakob number for heat transfer was applied to obtain numerical solutions for the cases of constant potential and constant current. Theoretical calculations for fluid flow and for mass transfer to rising bubbles or drops at both large Re and large Pe numbers were performed using the boundary layer approach of Levich. Satisfactory agreement was obtained when comparison was made to available experimental data. Possible extensions for future investigations were outlined. (Author abstract modified)

6736 APTIC NUMBER 16163

Cherednik, E. M., N. M. Morozov, and M. I. Temkin
KINETICS OF CARBON MONOXIDE CONVERSION ON A LOW-TEMPERATURE CATALYST. Kinetics Catalysis (USSR) (English translation from Russian of: Kinetika i Kataliz), 10(3):494-496, May-June, 1969. 3 refs.

The kinetics of the reaction of carbon monoxide with water vapor on a low temperature zinc-chromium-copper catalyst were studied. The measurements were performed at atmospheric pressure in the range 150-225 C in a continuous flow-circulation system. In the investigated range of temperature and gas-mixture compositions, the reaction was practically irreversible. An equation was derived to express the reaction rate.

6737 APTIC NUMBER 16379

Chertkov, B. A.
THEORY OF OXIDATION OF SULFITE-BISULFITE SOLUTIONS. (K teorii okisleniya sul'fit-bisul'fitnykh rastvorov). Text in Russian. Zh. Prikl. Khim., 32(12):2609-2613, 1959. 9 refs.

The deviation from a theory of oxidation of sulfite-bisulfite solutions with impurities (thiosulfate and trithionate in particular) under industrial conditions was examined. The oxidation rate increased significantly with even a slight thionate content. An explanation of the catalytic role of thiosulfate in the overall mechanism of oxidation of sulfite-bisulfite solutions was given and was based on earlier research by the same author on the oxidation of ammonium sulfite-bisulfite.

6738 APTIC NUMBER 15816

Christian, Sherril D. and Just Grundnes
CHARGE-TRANSFER COMPLEX BETWEEN SULPHUR DIOXIDE AND TRIMETHYLAMINE IN THE GAS PHASE AND IN HEPTANE. Nature, vol.214:1111-1112, June 10, 1967. 7 refs.

Spectral and thermodynamic parameters were obtained for a trimethylamine-sulfur dioxide complex in the gas phase at 15-60 C and in heptane at 13-40 C. In sixteen gas-cell experiments at 39.7 C with amine concentrations from 0.0004 to 0.0049 moles/l and sulfur dioxide concentrations from 0.000023 to 0.000059 moles/l, the peak absorbancy of the complex varied from 0.10-0.60 cm. Ultraviolet spectra of the complex were very similar in both phases; Spectral parameters and the variation of spectral and thermodynamic constants with temperature were almost identical. Apparently, the mechanisms responsible for the effect of the medium on the spectral characteristics of weaker complexes are not important in this system. The increase in the complex formation constant (Kc) and minus delta H(enthalpy at the standard state) which occurs as the medium is changed from gas to heptane, suggests that this highly polar complex is more strongly solvated than the sum of its uncombined components. Preliminary results indicate that both Kc and minus delta H become even larger in polar solvents.

6739 APTIC NUMBER 16453

Coester, J. Y. and Ph. Vautier
REALIZATION OF A HIGH-GAIN AMPLIFIER WITHOUT GAS CIRCULATION OPERATING BETWEEN 9 AND 11 MICRON. (Realisation d'un amplificateur a grand gain sans circulation de gaz fonctionnant entre get 11 micron). Text in French. Infrared Phys., 7(4):173-180, 1967. 8 refs.

Amplification of infrared wave lengths between 9 and 11 micron from a carbon dioxide laser was achieved in a multi-path cell. Gains of 15 dB were attained. A theoretical derivation of the amplification coefficient led to analytical expression with which the populations of the vibrational levels can be determined from measurements of the amplification gain. The functional dependence of gain on the input-power level and the frequency of the radiation emitted by the laser was also studied.

6740 APTIC NUMBER 16307

Collier, Susan S., Akira Horikawa, David H. Slater, Jack G. Calvert, George Reinhardt, and Edward Damon
THE LIFETIME AND QUENCHING RATE CONSTANT FOR THE LOWEST TRIPLET STATE OF SULFUR DIOXIDE. J. Am. Chem. Soc., 92(1):217-218, Jan. 1970. 5 refs.

The lifetime of a sulfur dioxide triplet species which was generated in two distinct photochemical ways was determined. The first method was direct laser light excitation of sulfur dioxide to the first excited triplet state by absorption at 3828.8 A within the forbidden triplet - singlet band in the pressure range 1-25 Torr. Excitation occurred only in the reaction SO2 + light (3828.8 A) yields the first excited triplet state of SO2. Triplet decay was seen in the reactions: first excited triplet state yields SO2 + light or SO2, and first excited triplet state yields SO3 + SO or 2SO2. The second method employed was flash photolytic excitation of sulfur dioxide to the first excited singlet state with subsequent triplet population by intersystem crossing at pressures of 0.02-0.15 Torr. Excitation of sulfur dioxide occurred in the reaction SO2 + light (2500-3300 A) yields the first excited singlet state. Triplet formation, and excited singlet and triplet molecule decay, resulted from a series of reactions: first excited triplet state yields SO2 + light or SO2; first excited triplet state + SO2 yields SO3 + SO or 2SO2; the first excited singlet state + SO2 yields 2SO2 or the first excited triplet state + SO2; and the first excited singlet state yields SO2 + light or SO2 or the first excited triplet state. It was concluded from the graphs of inverse triplet lifetime vs. sulfur dioxide pressure that the triplet lifetime is a linked function of the sulfur dioxide pressure. The reactivity of the triplet toward SO2 is not a strong function of the vibrational level in which the triplet is first formed. Vibrational equilibration of the triplet is practically complete for all of the conditions employed. These results are in opposition to those presented by Caton and Duncan who showed no dependence of sulfur dioxide pressure.

6741 APTIC NUMBER 16161

Coltharp, W. N., J. T. Scott, and E. E. Muschlitz, Jr.
MOLECULAR BEAM INVESTIGATIONS OF THE DISSOCIATION OF NITROUS OXIDE ON TUNGSTEN. J. Chem. Phys., 51(11):5180-5181, Dec. 1969. 4 refs.

Experiments were performed using modulated beam techniques, including the use of a lock-in amplifier. By rotating a quadropole mass spectrometer about a tungsten ribbon target, the spatial distributions of both the reflected N2O and the N2 dissociation product were determined. With a beam of N2O incident on the surface, it was found that both nitrogen and nitric oxide could be observed at temperatures above 1800 K. At 2500 K, the ratio of N2 to NO was found to be 12 + or - 2. While the N2O

distribution was found to be lobular at high temperatures, both the N2 and NO distributions were found to be diffuse. This was interpreted to mean that these molecules remained on the surface for sufficient lengths of time for thermal equilibrium to be achieved since a lobular distribution would be expected, had the residence times been as short as that observed for the reflected N2O. Attempts to find other products such as oxygen and nitrogen atoms were unsuccessful. To confirm the results, measurements were made of the angular distribution of reflected beams of N2 and NO from the same surface. At 2500 K, sharp lobular patterns were observed, with maxima shifted away from the specular angle toward the normal to the surface in contrast to the diffuse patterns observed for the N2 and NO resulting from the dissociation of N2O. The N2 and NO molecules formed in the dissociation of N2O on tungsten originate from N2O molecules that remained on the surface for times which are long compared with the vibrational period of the surface atoms, but short compared with the beam-modulation period. On the other hand, the lobular distributions observed for the reflected N2O, N2, and NO molecules indicated that these molecules remained on the surface for a period short compared with the vibrational period of the surface atoms. The results were consistent with the expected prediction that a sticky collision of the N2O molecule is required for dissociation to occur.

6742 APTIC NUMBER 16575

Condiff, Duane W., Wei-Kao Lu, and John S. Dahler
TRANSPORT PROPERTIES OF POLYATOMIC FLUIDS, A DILUTE GAS OF PERFECTLY ROUGH SPHERES. J Chem. Phys., vol. 49:3445-3475, 1965. 15 refs.

A detailed account is given of the kinetic theory for a fluid composed of perfectly rough spheres. When the method of Chapman and Enskog is applied to a dilute gas of these spheres the nonequilibrium distribution function satisfies a nonself-adjoint integral equation. The solution of this equation is not an isotropic function of the molecular spin velocity. A study was made of the bearing of this spin anisotropy upon the calculated values for the gas transport coefficients. A lengthy section is devoted to a detailed description of the manipulations which are involved in obtaining approximate solutions of the Chapman-Enskog equations. It is concluded that spin anisotropy contributes significantly to the calculated value of the thermal conductivity but it is negligible in its effects upon the coefficients of shear and bulk viscosity. The terms of the distribution function which are odd in the spin velocity do not seem to be of great importance. Collisions of rough spheres and the equations of fluid mechanics; H theorem and entropy production; properties of the Chapman-Enskog equation; evaluation of the bracket integrals; and theory for a mixture of rough spheres are appended.

6743 APTIC NUMBER 16098

Coutant, R. W., J. S. McNulty, R. E. Barrett, J. J. Carson, R. Fischer, and F H. Lougher
INVESTIGATION OF THE REACTIVITY OF LIMESTONE AND DOLOMITE FOR CAPTURING SO2 FROM FLUE GAS. (SUMMARY REPORT). Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., NAPCA Contract PH-86-67-115, 65p., Aug. 30, 1968. 16 refs.
CFSTI:PB 179907

An experimental reactor was designed, constructed, and used for determining the rates of reaction of 25 limestones and dolomites with SO2 under conditions that simulate localized conditions in a conventional power-generating boiler. With a stone of BCR-1359, an apparent activation energy of 28 kcal/mole was found for the SO2 reaction between 1500 and 2150 F. Data for other stones were less complete. The high activation energy for the reaction of BCR-1539 would seem to rule out film diffusion as a rate-controlling mechanism. A study of the dependence of rate of reaction on particle size seems to indicate chemical control of the reaction rate. A number of samples of BCR-1359 previously exposed in the reactor, were examined by thermogravimetric analysis (TGA) and were found to contain considerable amounts of uncalcined limestone. A correlation was found between the extent of calcination and extent of SO2 reaction, suggesting that the rates of the two processes are controlled by a similar mechanism. The reaction rate of BCR-1359 was indicated to be first order with respect to SO2 concentration by both reactor and microbalance studies. However, the concentration of SO2 has no effect of reaction capacity under the conditions employed in the microbalance. The microbalance results indicate that the chemistry of the reaction between limestone and SO2 is quite complex. Sulfite is formed initially when the oxygen concentration is low, but the sulfite is readily converted to sulfate either by reaction with oxygen or by a disproportionation-type reaction. Even at high oxygen levels, sulfite is probably the initial reaction product, with sulfate formation resulting from rapid secondary reactions. It was concluded that the overall rate of reaction depends upon the rate of formation of the lime by calcination of the limestone, the rate of destruction of thy porous structure of the lime by dead burning, and the rate of removal of the lime from an active state by reaction with the flyash. (Author summary modified)

6744 APTIC NUMBER 15804

Csathy, Denis
EVALUATING BOILERS DESIGNS FOR PROCESS-HEAT RECOVERY. Chem. Eng., 74(12):117-124, June 5, 1967.

Waste-heat boilers are categorized as either firetube, where the hot gas travels through the inside of the tubes with cooling water circulating on the outside, or watertube, where the opposite is true. Watertube boilers are available with either plain tubes (used only for small volumes of gases or gases with relatively high temperatures) or finned tubes (which permit heating surfaces eight to ten times greater than bare tubes in the same boiler volume). Gas-turbined heat-recovery boilers exemplify an application for finned watertubes. Firetube boilers are subject to leaks or cracks in tubesheets, due to the designer overlooking thermal expansion problems. When the inlet gas temperature exceeds 1400 deg F, the tubesheet is protected from the radiant heat of the gas with a layer of refractory. The most important design parameter for process-gas boilers is heat flux. The high pressure and the low specific

voluse of the gas permit a high mass flow without excessive gas velocity or pressure drop, thus creating a high heat-transfer. Circulation is the most important overall design consideration. In a single-pass firetube boiler, circulation which runs parallel to the shell is preferred. Firetube boilers in acid plants require special consideration because of corrosion. In sulfuric acid plants, waste-heat boilers are used to cool the combustion products of the sulfur furnace before entering the converter. If such boilers are operating at low steam pressure, the refractory protection of the hot tubesheet could be omitted. Gas boilers using the watertube process and combinations of watertube-firetube boilers have also been designed.

6745 APTIC NUMBER 16077

Curran, George P. and Everett Gorin
BENCH-SCALE RESEARCH ON CSG PROCESS. STUDIES ON MECHANICS OF FLUO-SOLIDS SYSTEMS. PHASE II. Consolidation Coal Co., Library, Pa., Research Div., Contract 14-01-0001-415, R and D Rept., 16, Interim Report 3, Book I, 105p., 1968. 27 refs.
CFSTI: PB 184718

The basic operability and mechanics of the dual fluo-solids system proposed in the CO2 acceptor process for converting coal into pipeline gas and/or hydrogen were demonstrated in cold model units. The basic vessel design for the gasifier and devolatilizer consisting of a boot of restricted cross section in which a fluidized acceptor bed was maintained and on which the main fluidized char bed of enlarged cross section was superimposed was proven out. It was shown that properly sized dolosite could be showered through the char bed without difficulty. Rapid distribution of the falling acceptor in the char bed was demonstrated without the aid of mechanical devices or baffles. A generalized correlation was derived to predict bed densities over a wide range of values for the appropriate parameters of gas velocity, gas viscosity, solids size consist, shape, and density. The correlation is useful for prediction of bed inventories under conditioned obtained in the various vessels of the CO2 acceptor process. The correlation was tested and found to hold over a wide range of operating parameters, and for liquid as well as gas-solid fluidized systems. A quantitative correlation was derived for prediction of pressure drops under unusual conditions prevailing in transfer lines in the CO2 acceptor process. It was shown that the pressure drop is sufficiently small, so no difficulty should be experienced in maintaining pressure balance within the standleg height provided. An espirical relationship was derived from experimental data which permits the calculation of acceptor falling velocity as a function of acceptor particle size, acceptor density, and char fluid bed density.

6746 APTIC NUMBER 16381

Currie, J. A.
GASEOUS DIFFUSION IN POROUS MEDIA. PART 1. A NON-STEADY STATE METHOD. Brit. J. Appl. Phys., 11(8):314-324, Aug. 1960. 13 refs.

Laboratory equipment, capable of modifications for use on soils in the field, was constructed to study diffusion in porous systems. A simple katharometer measured the instantaneous composition of hydrogen/air mixtures by using the exposed element of a thermal milliammeter. When 15 mW of energy were dissipated in the hot wire, sensitivity of the analyzer became adequate; thermal drift of the element in air changed the thermocouple output by less than 1 microvolt/min. Thermal drift could be eliminated by continuously changing the sample being analyzed. The geometry of the experimental system was simple enough to permit a standard solution of the non-steady state equation for interdiffusion of two gases to be applied. As a check on performance, straight tubes of slightly varying geometry were used to measure the diffusion coefficient of hydrogen into air and its dependence on temperature. Reproducibility was very good and, within the limits of experimental error, the coefficient obtained was the same for 100% hydrogen into 100% air as for 60% air + 40% hydrogen into 100% air. (Author abstract modified)

6747 APTIC NUMBER 16469

Curtiss, C. F.
KINETIC THEORY OF NONSPHERICAL MOLECULES. J. Chem. Phys., 24(2): 225-241, Jan.-June 1956. 5 refs. (Presented at American Chemical Society Meeting, Cincinnati, Ohio, April 4, 1955.)

A modification of the Boltzmann equation was described in which the rotational motion of nonspherical molecules is classically considered. This Boltzmann equation leads to equations of continuity, motion, and energy balance similar to the equations applying when the molecules are spherical. An additional equation of change arises, however, because of the conservation of angular momentum in collisions. (When the molecules are spherical, this equation is redundant.) Associated with the additional equation of change, there appears an additional macroscopic variable related to the local density of angular momentum due to the rotational motion of the molecules and an additional flux vector representing the flux or transport of this angular momentum. The Boltzmann equation is solved by a perturbation method similar to the Chapman-Enskog first approximation, and expressions are obtained for the various flux vectors and transport coefficients. Although the equations of change apply under more general conditions, the present treatment is restricted to molecules which may be idealized as rigid nonspherical bodies in which the center of mass is a center of symmetry. (Author abstract modified)

6748 APTIC NUMBER 16597

Danner, G. and M. Rey
REFERENCE ELECTRODES FOR HIGH TEMPERATURES. (Electrodes de reference pour hautes temperatures). Text in French. Electrochim. Acta, 4(2-4):274-287, 1961. 16 refs. (Presented at the CITCE 11th Meeting, Vienna, Sept. 1959.)

A reference electrode was developed, based on the system Ag/Ag(+), where the silver ions were diluted by a K2SO4-Li2SO4 eutectic; the pyrex sheath played the role of the electrolyte

of the junction. It performed very satisfactorily at temperatures up to 960 C, the melting point of silver. A modified form of this electrode was also developed where a drop of molten silver was in contact with the K2SO4-Li2SO4 eutectic. The resulting change of the electrochemical equilibrium was fully compensated by the use of a platinum electrode, which was capable of operating at temperatures up to 1300 C. The polarizability, reversibility, stability, and reproducibility of both electrodes were demonstrated by means of test curves. Several anodic polarization curves obtained with the aid of the reference electrode were also shown as illustrations of its possible applications.

6749 APTIC NUMBER 15807

Davies, G. A., A. B. Ponter, and K. Craine
THE DIFFUSION OF CARBON DIOXIDE IN ORGANIC LIQUIDS. Can. J. Chem. Eng., 45(6):372-376, Dec. 1967. 24 refs.

To develop design equations necessary to size mass transfer equipment, the diffusion of carbon dioxide was studied in a range of organic liquids and hydrocarbon mixtures over a sixty-fold range of solvent viscosity. All available models for predicting gas-liquid diffusion coefficients were tested to correlate the experimental data. Hydrodynamic theories and absolute rate theories predicting that diffusitivity is an inverse function of solvent viscosity did not fit the data. The data are best fitted by Arnold's empirical equation. Until more exact models of the liquid state become available, this method is the most reliable for predicting CO2 diffusion coefficients in organic liquids with an upper solvent viscosity limit of 150 cp.

6750 APTIC NUMBER 16434

Dipali, M. L. and V. R. Dani
COMPLEX COMPOUNDS OF CADMIUM NITRITE WITH ALKALI NITRITES. PART I. CONDUCTOMETRIC STUDIES. J. Karnatak Univ., vol. 1:29-35, 1956. 11 refs.

Complex formation in the systems cadmium nitrate-potassium nitrite-water, cadmium nitrite-sodium nitrite-water, and cadmium nitrite-lithium nitrite-water was studied at 30 C by plotting the amount of cadmium nitrite in ccs against the specific conductivities of the solutions. As established by breaks at 2.5, 5, and 10 cc, cadmium nitrite and potassium nitrite formed three complex salts that were isolated and identified as 4KNO2-1Cd(NO2)2, 2KNO2-1Cd(NO2)2, and KNC2Cd(NO2)2. Similar discontinuities were observed for cadmium nitrite and sodium nitrite. The salts, which could not be isolated, are presumed to be 4NaNO2-1Cd(NO2)2, 2NaNO2-1Cd(NO2)2, and NaNO2-Cd(NO2)2. No compounds were formed by the reaction of cadmium nitrite with lithium nitrite. The results are in agreement with the observed tendency of alkali nitrites to vary in their capacity to form complex salts according to the atomic weight of the element.

6751 APTIC NUMBER 15800

Dodgson, John Wallis
THE REDUCTION OF SUBSTITUTED P-BENZOQUINONES BY SULPHUR DIOXIDE ALONE AND IN THE PRESENCE OF ALKALI. J. Chem. Soc, 1930 (Part 2):2498-2502.

Sulfonic acids are regularly formed by the action of sulfurous acid on quinones. Direct reduction also takes place. In chloroquinones, there is a tendency to form disulfonic acids. The formation of sulfonic acids by neutral sulfites is largely in excess of reduction of the quinone; it must be the result of the presence of sulfonic ion, which demands previous hydrolysis of the sulfite. Additional alkali inhibits this hydrolysis, which is probably a contributing cause of the falling off of sulfonate as the proportion of alkali increases. The action of excess alkali apparently leads to destruction of the quinone through the formation of highly colored unstable compounds. (Author summary modified)

6752 APTIC NUMBER 15797

Dokladalova, J. and O. Stankova
THE SCHIFF REACTION EMPLOYING A COMPLEXLY BOUND SULFUR DIOXIDE. (Die Schiffsche Reaktion unter Verwendung von komplex gebundenem Schwefeldioxid). Text in German. Mikrochim. Acta (Vienna), no. 1:219-227, 1968. 6 refs.

During formaldehyde determination by a complexly bound sulfur dioxide in the form of dichlorosulfitomercurate, it was found that a decisive influence on sensitivity is exerted by the reversible dissociation on the central C-atom of p-rosanilinmethanesulfonic acid. This reaction proceeds very rapidly and consequently does not appear kinetically. The substitution of the aromatic amino groups by alkylsulfonic acid radicals determines the velocity of the total reaction. The use of hydrochloric acid to convert p-rosanilin hydrochloride into the leuco compound and the complex binding of sulfur dioxide eliminate the action of the highly nucleophilic HSO3(-) ions on the central C-atom of the colored end product. This raises the sensitivity of the customarily used Schiff reagent. (Author summary modified)

6753 APTIC NUMBER 18667

Dubinin, M. M.
THE POTENTIAL THEORY OF THE ADSORPTION OF GASES AND VAPOURS ON ADSORBENTS WITH ENERGY-HETEROGENEOUS SURFACES. In: Catal. Chem. Kinet. 1964, W. Trzebiatowski (ed.), New York, Academic Press, Chapt. 2, p. 17-31. 13 refs.

This paper summarizes results of theoretical and experimental studies conducted by other investigators. The conclusions have contributed to the development of the potential theory of adsorption where dispersion forces are of primary importance. The ideas formulated in the paper may be applied to the physical adsorption of gases and vapors on carbon non-polar adsorbents. They are also important to other adsorbent-adsorbate systems

if the predominant factor in adsorptive interaction is dispersion forces. The basic characteristic feature of the field of adsorption forces is the distribution of the filled adsorption volume with respect to adsorption potentials. Since the adsorption potential expresses the work of dispersion forces independently of temperature, the distribution curve is independent of temperature. It was established that due to the effect of the increase in adsorption potential within the carbon micropores, the characteristic curve of an absorbent represents its porous structure. The first structural type of adsorbent includes active carbons with very fine micropores with inherent increased adsorption potentials resulting from the superposition of forces of the opposite capillary walls. The second structural type of adsorbent comprises active carbons with large micropores where there is no superposition of fields opposite capillary walls and no increase in adsorption potentials. The theoretical ideas allow a quantitative description of the physical adsorption of gases and vapors on real adsorbents over a wide range of temperatures including the region of critical temperature. Furthermore, they correlate the adsorption process to the porous structure of adsorbents and permit the estimation of the adsorbability of substances from their physical constants and the calculation of the dependence of the differential heat of adsorption from adsorption isotherm equations.

6754 APTIC NUMBER 14868

Duke, F. R. and M. L. Iverson
COMPLEX IONS IN FUSED SALTS. J. Phys. Chem., 62(4):417-419, April 1958. 12 refs.

The complex ion formation constants for a series of bivalent metal halides were determined using fused KNO3-NaNO3 eutectic mixtures as a solvent. The method involved measuring the increase in solubility of the slightly soluble metal chromate as halide ion was added. The solubility of lead chromate increases with increasing sodium chloride content up to the limiting solubility of sodium chloride. A similar increase in solubility is shown with the addition of sodium bromide. The solubility of cadmium chromate also increases with the addition of chloride or bromide and forms a more stable complex with halide ions than lead. The solubilities of the chromium salts of magnesium, calcium, and barium are not affected significantly by the addition of halides. The increase in solubility of a salt was interpreted on the basis of complex ion formation. It was evident that the trend is toward a decrease in stability of the complex with an increase in temperature in the case of lead. An interpretation of the data on the basis of stable complex ions does not indicate whether the complex is of ionic or chemical, since the role of the solvent is not known.

6755 APTIC NUMBER 14529

Duke, Frederick R. and Elizabeth A. Shute
THE CATALYTIC DECOMPOSITION OF BROMATE IN FUSED ALKALI NITRATES. J. Phys. Chem., vol. 66:2114-2116, Nov. 1962. 3 refs.

An investigation of the catalytic effect of bromide on the decomposition of bromate was prompted by the observation that solutions of bromate in fused alkali nitrates eventually decompose to bromide and oxygen. In fused NaNO3, KNO3, or NaNO3-KNO3 mixtures, the decomposition reaction was found to be first order and catalyzed by bromide. Decomposition proceeds by a slow rate-controlling step: BrO3(-) plus Br(-) yields BrO2(-) plus BrO(-), followed by rapid reactions of the intermediates to give the final products: BrO(-) plus BrO3(-) yields 2BrO2(-) and BrO2(-) yields Br(-) plus O2. The overall reaction would be 2BrO3(-) plus Br(-) yields 3Br(-) plus 3O2. The activation energy for reaction in molten NaNO3 was determined to be 43 plus or minus 6 kcal/mole at a confidence level of 60%. The decomposition rate increases with decreasing size or increasing polarizing power of the alkali cation, suggesting that one or more of the cations become involved in the activated complex. By polarizing one or both of the reactants, the cation probably reduces the electrostatic repulsion between two like-charged cations and lowers the free energy of activation.

6756 APTIC NUMBER 15329

Dunken, H. and H. Winde
INTERACTIONS OF SULFUR DIOXIDE WITH POLAR COMPOUNDS. EFFECTS OBSERVABLE IN THE UV ABSORPTION SPECTRUM. (Wechselwirkungen des Schwefeldioxids mit polaren Verbindungen. Im UV-Absorptionsspektrum beobachtbare Auswirkungen). Text in German. Z. Physik. Chem. (Leipzig), 56(5/6):303-308, Dec. 1967. 5 refs.

The interactions of the sulfur dioxide molecule with ketones, nitriles, esters, chloroform, and alcohols were studied in the UV range between 330 nm and 250 nm. The ketones were boiled with KMnO4 and dried with sodium sulfate and fractionated in a vacuum; carbon tetrachloride(CCl4) and n-octane were shaken with sulfuric acid, neutralized, dried, and fractionated. The SO2 was taken from a steel container and dried with P2O5. Iodimetry was used for analysis of the sulfur dioxide. Considerably different spectra were obtained for the system SO2/propiontrile and SO2/CCl4 or SO2/aliphatic hydrocarbons, although SO2 concentrations were the same in all cases. From the region of longer wavelength to about 294 nm, the extinction coefficient of the sulfur dioxide in solutions of nitriles, ketones, esters, and alcohols is smaller than that in CCl4 solution. At 294 nm, the situation reverses and the extinction coefficient of sulfur dioxide in solutions of the polar compounds is considerably larger than that in CCl4 solutions.

6757 APTIC NUMBER 13713

Durau, F. and V. Schratz
STUDY OF ADSORPTION HEATS OF SO2 AND C3H8 ON NACL AND OF C3H8 AND C2H6 ON DECOMPOSED KMNO4. (Ueber Adsorptionswaermen von SO2 und C3H8 an NaCl und Von C3H8 und C2H6 an zersetzten KMnO4). Text in German. Z. Physik. Chem. Abt. A (Leipzig), 159(2-3):115-130, 1932. 22 refs.

In an experimental set-up completely isolated from the atmosphere, the adsorption isotherms of SO2 and propane (C3H8) on

NaCl powder and of C3H8 and ethane (C2H6) on decomposed KMnO4 in the temperature range from 0 C to 40 C were determined. To increase the accuracy of the measurement, the experimental set-up was enclosed in a thermostat especially constructed for this purpose. The NaCl powder was obtained by melting cleaned NaCl in a high vacuum and by pulverizing the crystals in a nitrogen atmosphere. The KMnO4 was prepared by heating under low pressure without contacting any gas other than the oxygen liberated during the process. The adsorption heats were determined and results show that adsorption is caused by van der Waal forces. The experiments also confirmed observations made with coal, namely that the individual surface points develop different energies. Surface points with high adsorption potential cause chemisorption, which was weak between SO2 and NaCl and more pronounced between C2H6 and C3H8 and decomposed KMnO4. The points of high adsorption potential disappear by crystalline transformation due to heating.

6758 APTIC NUMBER 15305

Dzhamaletdinova, M. K.
SIMULTANEOUS MICRODETERMINATION OF CARBON, HYDROGEN, AND URANIUM. (Odnovremennoye mikroopredeleniye ugleroda, vodoroda i urana). Text in Russian. Zavodsk. Lab. (Moscow), 29(10): 1175-1176, 1964.

The possibility of simultaneously making quantitative determinations of carbon, hydrogen, and uranium in 3-5 mg samples of organic uranium compounds was demonstrated. Gravimetric analysis is used and takes advantage of the fact that above 500 C in an oxygen atmosphere, quantitative formation of stable U3O8 takes place, while at 800 C, uranium does not form either the carbide or the carbonyl. The method described takes 35-40 minutes and shows a relative error of 0.2%.

6759 APTIC NUMBER 14655

Ebersole, G. D.
COMPUTER STUDY OF GASOLINE VOLATILITY AND VEHICLE PERFORMANCE. Preprint, Society of Automotive Engineers, Inc., New York, 16p., 1969. 24 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690208.)

Important fuel/vehicle variables that influence vapor lock were investigated by simulating on a digital computer the mechanism of vapor lock during full throttle accelerations in place of experimental determination. The computer program, which was based on empirical data from the fuels and vehicle, was used to study the relationships among fuel composition, ambient temperature and elevation, changes in fuel system design, and vehicle performance. The calculated vehicle performance agreed with the experimental data using fuels of Reid vapor pressure (Rvp) equal to 10.0 to 11.5. Calculated results with fuels above Rvp equal 11.5 are slightly less severe than experimental determination, probably because the calculated fuel demand, and thus the required fuel supply, was less than the actual requirement of the vehicle during the transition period. These transition periods are encountered only when the increase in acceleration time is above 60%. The effects of ambient temperature and elevation on a given level of vehicle performance (25% increase in acceleration time) with a given fuel series were anticipated. Results also showed that larger bowl capacities can reduce the fuel flow requirement from the pump, consequently equivalent vehicle performance levels can be maintained with higher vapor pressure levels. Vehicle performance was sensitive to changes in the liquid or vapor handling capacities of the pump. The calculated results agreed well with experimental results obtained on the vehicle dynamometer and on the road. This method should relieve time and economic limitations that prohibited comprehensive studies of this subject. Application of the program showed that the differences in Reid vapor pressure between a pentanized and a butanized fuel series at equivalent vapor lock performance levels are not constant but change with ambient temperature, elevation, carburetor bowl capacity, and fuel pump design.

6760 APTIC NUMBER 16412

Eckert, Charles A.
MOLECULAR THERMODYNAMICS OF CHEMICAL REACTIONS. Ind. Eng. Chem., 59(9):20-32, Sept. 1967. 45 refs.

Chemical engineers can influence the rate of chemical reactions or adjust the relative rates of competing reactions by a rational choice of solvent or solvent mixture, based on a judicious application of molecular thermodynamics. The approach described uses the absolute rate theory to reduce the rate problem to an equilibrium, or thermodynamic, problem. The advantage of this is that thermodynamics is far better understood than rate processes. Furthermore, advances in molecular thermodynamics and applications of statistical mechanics provide insight into problems of phase equilibrium and solution theory. Such techniques can be applied in conjunction with existing knowledge about intermolecular forces to predict how the rate of reaction is affected by pressure, temperature, and solvent medium. The techniques can also be used to treat heterogeneous rate problems and to design solvents for optimizing reactions. Gas and liquid phase reactions are described in terms of reaction rates.

6761 APTIC NUMBER 15854

Eckert, John S., Earl H. Foote, Leonard H. Rellison, and Louis F. Walter
ABSORPTION PROCESS UTILIZING PACKED TOWERS. Ind. Eng. Chem., 59(2):41-47, Feb. 1967. 19 refs.

Current theory regarding absorption maintains that a soluble gas moves from the gas to the liquid phase under a driving pressure (the difference in pressure between the mole fraction in the gas phase and the vapor pressure of the same gas in equilibrium with the liquid phase). The rate of transfer of the gas is directly proportional to the driving force but is resisted by its diffusion rate in both the gas and liquid phases, a phenomenon known as liquid and gas film resistances. The film resistance used in industrial design is expressed as a combined constant.

The film constant is more usefully expressed by mass transport. The major problem is designing an absorber is determining the mass transfer coefficient for a packed tower and the plate efficiency for a plate tower. Gas induced agitation of the interface between the gas and the liquid will increase the rate of mass transfer so much that the influence of the factors affecting mass transfer based on film resistances can no longer be detected. The presence of a surfactant will have a retarding effect unless there is a large amount of agitation from gas friction. Gases whose solutions exhibit a high degree of dissociation have high mass transfer coefficients; gases which do not ionize in solution show mass transfer coefficients proportional to their solubilities. Increasing the temperature raises the rate of mass transfer; however, it usually reduces the solubility of the gas.

6762 APTIC NUMBER 15055

Eisenthal, K. B., W. L. Peticolas, and K. E. Rieckhoff
LASER-INDUCED LUMINESCENCE AND DISSOCIATION IN BIPHENYL. J. Chem. Phys., 44(12):4492-4497, June 15, 1966. 16 refs.

The interaction of the radiation field of an unfocused ruby laser with molecules containing a phenyl-phenyl or benzyl-benzyl single bond gave rise to a new luminescence. This luminescence is linearly dependent on the molecular concentration and proportional to either the second or the third power of the laser intensity. Thus it appears that a multiphoton absorption is occurring. The absorption does not appear to involve the electronic states of the molecules. This luminescence occurs throughout the visible region and bears no resemblance whatever to either the normal fluorescence or phosphorescence. Because of the exceedingly high laser intensities or electric fields necessary for electronic dielectric breakdown it appears that this mechanism is not of importance. It is suggested that multiphoton vibrational excitation to a dissociative state of the molecule may occur which leads to molecular fragmentation. This process is followed by a chemiluminescent emission. A quantitative comparison of the experimental results with a theoretical treatment of multiphoton vibrational dissociation is made. (Author abstract modified)

6763 APTIC NUMBER 16423

Eklund, Rolf-Bertil
THE RATE OF OXIDATION OF SULFUR DIOXIDE WITH A COMMERCIAL VANADIUM CATALYST. Royal Inst. of Tech., Stockholm, Sweden, Div. of Applied Inorganic Chemistry, Thesis (Ph. D.), Uppsala, Sweden, Almqvist and Wiksells Boktryckeriab, 1956, 83p. 27 refs.

The rate of oxidation of sulfur dioxide over a commercial potassium-vanadium catalyst was investigated. It was assumed that a rate expression derived from the postulate that the reaction occurs at the surface of the catalyst and involves the reaction of molecules of sulfur dioxide and oxygen atoms, which are chemically adsorbed on the active centers, describes the experimentally determined rate of reaction. It was found that none of the derived rate equations described the rate of reaction. The theoretically developed rate equation showed, however, that if the reaction between oxygen and the active component of the catalyst is the slow rate determining step, the initial rate of the reaction will be directly proportional to the partial pressure of oxygen. The expression for the driving force is given. Although the theoretically developed rate equations did not describe the rate of the reaction, they indicated how the preliminary developed rate equation should be modified. The rate equation arrived at a factor which may be thought of as an expression for the variation of the activity of the catalyst at varying partial pressure of sulfur dioxide and sulfur trioxide. No theoretical derivation of this factor was found. A comparison with rate expressions previously published and the experimental rates of reaction over vanadium catalysts of different compositions showed that the rate equation might possibly describe the rate of oxidation of sulfur dioxide over any vanadium catalyst, and that only the reaction rate constant is influenced by a change in composition of the vanadium catalyst. The experimental rate determinations showed that within the investigated concentration range, a varying partial pressure of sulfur trioxide or sulfur dioxide does not seem to influence the effectivity factor of the catalyst. The derived rate constant for small sized particles and the experimental rate constant for a catalyst of technical size shows the same variation with temperature. (Author conclusions modified)

6764 APTIC NUMBER 16512

Ellis, Richard B.
FUSED SALTS. Chem. Eng. News, vol. 38:96-100, 102, 104, 106, Oct. 10, 1960.

The commercial importance of fused salts and research being done on them are reviewed. The most important use of fused salts is in making aluminum, magnesium, sodium, and less common metals. They are also aiding in the development of atomic power. Advantages over solid fuels include lower cost and continuous removal of undesirable fission products. An excess of reactive material is unnecessary, and nuclear radiation cannot structurally damage molten flucride fuels. They also permit reactors to operate at lower pressures and higher temperatures and dissolve a higher percentage of materials that are either fertile or are already fissionable. Fused salts are used in the making of high-purity uranium metal. Fused salt mixtures containing cryolite or other flucrides are being used as a flux to protect the surface of hot-dip aluminum coating baths. In baths for nitriding steels, fused salts can act as both flux and reagent and in descaling metals, they may be effective where ordinary acids fail. They are also effective as heat transferring agents and can closely control the temperature of reactive gases and vapors when these are bubbled through a fused salt bath. In many of their uses, the fused salts remain chemically inert, acting solely as a solvent or heat transfer medium. However, their use as chemical reagents is attracting more and more attention. What is especially needed is a better understanding of the fundamental processes involved in fused salt reactions. Conductivity, ionic mobility, transport numbers, and phase relationships have been studied. As knowledge of them grows, fused salts will contribute even more to chemical progress.

6765 APTIC NUMBER 15107

Ellis, S. R. M.
THE SELECTION OF METHODS OF SEPARATION. J. Appl. Chem. (London), vol. 16:184-186, June 1966. 7 refs.

During the last 20 years the variety of multistage separation methods in engineering use has increased rapidly. In examining the application of such methods of separation to a particular problem, the first step is usually to determine or predict equilibria or rate data which are classified according to type of diffusion, phase separation methods, relative flow of phases, and energy requirements. Having confirmed the feasibility of separation, the selection of the best method is then largely based on economic considerations. Of the classical methods of separation, fractional distillation is usually the first choice because it is suitable for automatic control, is a potentially reversible process, and requires no extraneous materials. Extractive and azeotropic distillation, gas absorption, and liquid-liquid extraction require solvents, and consequently the processes are more expensive to handle than distillation. Among other methods, continuous adsorption or chromatography separation promise to become increasingly important. If, because of an unfavorable separation factor, none of these methods can be used, only then is consideration given to high energy, irreversible processes such as thermal diffusion, membrane processes, and zone melting.

6766 APTIC NUMBER 14513

Elving, Philip J. and Joseph M. Markowitz
CHEMISTRY OF SOLUTIONS IN LIQUID SULFUR DIOXIDE. J. Chem. Educ., 37(2):75-81, Feb. 1960. 61 refs.

Liquid sulfur dioxide possesses potentially useful properties as a solvent. It dissolves many inorganic compounds, is a much better solvent for organic compounds than water, and it forms crystalline solvates with many solutes. Although its electrical conductivity in the pure state is low, its solutions are frequently good conductors. Walden explained the small conductivity of pure sulfur dioxide and the reported cathodic deposit of sulfur on electrolysis by presumed auto-ionization of sulfur dioxide to positively charged sulfur ions and negatively charged oxygen ions. Jander and his coworkers suggested that auto-ionization occurred according to the reaction SO2 yields SO(II) plus O(2-) and the overall reaction 2SO2 yields SO(II) plus SO3(2-). Thionyl sulfate ions were thought to really exist and to have functions analogous to those of acid and basic ions. The reaction between a thionyl compound and a sulfite to produce a salt and solvent was considered neutralization. On the basis of more recent work, it is concluded that the amount of thionyl ion present in sulfur dioxide solutions is too small to explain 'neutralization' reactions between thionyl compounds and sulfites. The possibility exists that sulfite-solvent exchange proceeds directly by a transfer of oxide ion between solvent and sulfite, rather than indirectly through the sulfite ionization proposed by Jander. In the theory advanced by Huston, oxide transfer occurs according to the mechanism SO3(2-) plus S*O2 yields SO2 plus S*O3(2-). A comprehensive theory of liquid sulfur dioxide chemistry may someday result from a synthesis of these theories. The test of such a theory will be its ability to predict experimental behavior in such unexplored areas as catalyst in liquid sulfur dioxide.

6767 APTIC NUMBER 14600

Ephraim, Fritz and Clara Aellig
ON COMPLEXES OF SULFUR DIOXIDE. 26TH COMMUNICATION ON THE NATURE OF SUBSIDIARY VALENCE. (Ueber Komplexe mit Schwefeldioxyd. 26. Mitteilung ueber die Natur der Nebenvalenzen). Text in German. Helv. Chim. Acta, vol. 6:37-53, 1923. 14 refs.

The addition properties of the alkali salts of aliphatic acids were studied with respect to SO2. The formates, acetates, propionates, butyrates, valerates, and benzoates of sodium, potassium, rubidium, and cesium were investigated; the lithium and alkaline earth compounds do not add SO2. Of the formates, the Na salts contain no SO2, the K salts contain 1/2 mole SO2, the Rb and Cs salts contain one mole SO2, and all other salts contain 2 moles. Gaseous SO2 is only slowly absorbed, while liquid SO2 is absorbed faster. All compounds gradually loose some of the added SO2. Only the formates show an orange color; all other addition products are white or colorless. The nature of the yellow color of commercial sodium bisulfite solution was also studied. It is suggested that the yellow color is due to a complex which forms at concentrations higher than 0.5 M, since the optical absorption does not follow Beer's law. Aqueous NaOH solution absorbs about 0.6 mole SO2 per mole NaOH. The respective value for KOH is about 0.72.

6768 APTIC NUMBER 15115

Epstein, L. M. and K. H. Sun
CHEMICAL REACTIONS INDUCED IN GASES BY MEANS OF A LASER. Nature, 211(5054):1173-1174, Sept. 10, 1966. 1 ref.

In the course of studying the heating of gases by laser light pulses, residual gases were analyzed and in some cases a significant change in composition was found. The gases irradiated were CH4, 10%CH4-90%N2, CO2, 20%CO2-80%D2, 73%H2-27%N2, 55%O2-45%N2, and solid graphite in H2. Although the temperature within the directly irradiated volume was sufficient to cause complete dissociation and ionization, the low overall energy requirements imply that the number of molecules decomposed far exceeded the number originally ionized, and that most of the molecules decomposed received their energy indirectly. The pattern of product formation is what would be expected from high temperature reactions rather than from ionizing radiation. Thus there cannot be a large contribution resulting from any mechanism which involves irradiation from the cold gas with ions or hot atoms from the plasma. The reactions which did occur proceeded with 10-20% energy efficiency. The work indicated that the giant pulse laser can be conveniently used to study very high temperature chemical reactions. Studies to establish the dependence of yield on intensity and configuration of focal

spot would also determine the usefulness of the method as an absolute dosimeter or calorimeter for laser shots.

6769 APTIC NUMBER 15808

Antonini, Eraldo, Maurizio Brunori, Jeffries Wyman, and Robert W. Noble
PREPARATION AND KINETIC PROPERTIES OF INTERMEDIATES IN THE REACTION OF HEMOGLOBIN WITH LIGANDS. J. Biol. Chem., 241(13): 3236-3238, July 10, 1966. 9 refs.

Progress in understanding the mechanism of the reaction of hemoglobin with ligands can be made by studying the properties of the reaction intermediates. A method is described for preparing stable forms of these intermediates by reassembling hemoglobin from its respective deoxygenated and liganded chains. By taking advantage of the very slow dissociation of NO, compounds containing the species (alphaNO - beta) or (alpha -betaNO) are obtained by mixing NO chains with their deoxygenated partners. The kinetic behavior of these intermediates with CO can then be studied and compared with that of the isolated chains and of the fully unliganded chains. Experiments with CO show that the liganded isolated alpha or beta chains are able to react with their deoxygenated partners in stoichiometric amounts. The compounds which are formed are of the type (alpha-liganded beta-deoxy) or alpha-deoxy beta-liganded); they possibly have the same properties as the transient intermediates normally formed in the reaction of hemoglobin with ligands. The kinetic behavior of the deoxygenated chains in these compounds is similar to that of fully unliganded hemoglobin and wholly different from that of the isolated chains or from that of modified hemoglobins, which show no hese-hese interaction.

6770 APTIC NUMBER 14958

Erdos, E. and J. Bares
THE PREPARATION OF GAS MIXTURES WITH IOW CONCENTRATIONS OF SULPHUR DIOXIDE. Collection Czech. Chem. Commun. (Prague), 29(11):2718-2725, 1964. 6 refs.

A simple saturation method is presented for the laboratory preparation of gas mixtures with partial pressure of sulfur dioxide 0.02 to 2.5 mm Hg(i.e., 0.03 to 0.35 vol % of SO2 at atmospheric pressure). It can be used in conjunction with laboratory-scale studies of methods for removing sulfur dioxide from flue gases and also for the calibration of gas analyzers. Water solutions were prepared from sodium sulfite and an excess of sulfuric acid, to form a diluted solution of sulfurous acid, sulfuric acid, and sodium sulfate. The dependence of sulfur dioxide partial pressure on the composition of the solution at 18 C was experimentally determined, and an equation was derived for expressing the partial pressure above the solution in terms of macroscopic, directly measurable quantities. Since data on dissociation constants of sulfurous acid were not available for temperatures other than 18 C, an approximate treatment of temperature dependence was attempted. Additional measurements were made at 0, 7, and 13 C, and an equation was derived for expressing temperature dependence in the interval 0-18 C with an average accuracy of plus or minus 1.7%. This equation can also be used to calculate the heat of SO2 in the given aqueous solutions.

6771 APTIC NUMBER 16594

Estrin, Joseph, T. W. Hayes, and T. B. Drew
THE CONDENSATION OF MIXED VAPORS. Am. Inst. Chem. Engrs. J., 11(5):800-803, Sept. 1965. 14 refs.

Although condensation from saturated mixed vapors upon a cold surface was frequently explored experimentally, current theories describing this phenomenon were not adequately tested. The condensation process in which more than one component enters the liquid condensate phase, and how the mass transfer process is involved in their partial fractionation, was described. A discussion of the Bedingfield correction for the effect of molecular weight difference of the diffusing components upon the mass transfer coefficient led to a necessary association with the Ackermann factor for the general mass transfer effect. Data from two sets of experiments using different apparatus demonstrated the use of this net corrective factor and also demonstrated the general applicability of the Drew-Colburn mass transfer coefficient for transfer processes in which more than one component transfers from one phase to another. (Author abstract modified)

6772 APTIC NUMBER 15326

Euler, J. and K. H. Mueller
THE ACCURACY OF DETERMINATION OF CURRENT DISTRIBUTIONS IN POROUS ELECTRODES. (Ueber die Genauigkeit mit der sich Stromverteilungen in poroesen Elektroden ermitteln lassen). Text in German. Electrochim. Acta, 8(12):949-959, 1963. 19 refs.

The current distribution in porous electrodes of galvanic cells and accumulators can be obtained with limited accuracy only. This is due less to the inaccuracy of the calcuation or to the rough approximation of the polarization curve than to the fact that the basic parameters of the electrodes (such as the specific conductance for electrons and ions, the volume conductance at linear approximation or the exponent for the slope of the straight line at exponential approximation of the polarization curve as well as the 'height' of the potential distribution and a characteristic magnitude for the diffusion) cannot be measured accurately. That is, the first three parameters are measurable within large error margins, while the height of the potential distribution can only be estimated with the aid of the Pourbaix diagram. The situation is similar for the characteristic diffusion parameter. The first errors are introduced right after switching on the current at the approximate calculation of the initial current distribution. While the load is on, the current distribution curves flatten considerably. The parameters for mathematical expression of this phenomenon are frequently not measurable. All that can be obtaine is an estimate of the current distribution from the observed flattening. Thus, apart from special cases, only qualitative predictions can be made.

6773

APTIC NUMBER 14715

Eyzat, P. and J. C. Guibet
STUDY OF IGNITION IN DIESEL MOTORS. (Etude de l'inflammation dans les moteurs diesel). Text in French. Rev. Inst. Franc. Petrole, Ann. Combust. Liquides (Paris), 22(12):1856-1874, Dec. 1967. 10 refs. (Presented at the Conference on Road Vehicles and Motor Engineering, Esztergom, Hungary, Aug. 28-Sept. 2, 1967.)

Ignition delay is an important concept in diesel motor design. The necessity of securing ignition at low power or high rate gives a minimum compression ratio. In turbo-blown motors of fixed low compression ratio, the compression ratio necessary for low-power running limits the power obtainable by supercharging. Ignition occurs at a critical concentration of free radicals created through reaction chains, converting at least 70% of the fuel into carbonylated olefins with some carbon monoxide. Experiments with fast compression machines give the delay under known pressures, temperatures, and concentrations. The richness of minimum delay is near 1. Delay can be calculated for a motor by assuming a linear growth of free radical concentration in pre-ignition knowing the pressure and temperature variation before ignition, and using fast compression machine data for the richness giving minimum delay, and adding the initial evaporation delay. In a motor compression ratio of 15 at 1000 rmp, a richness of 0.18 was necessary for steady running, but below this, carbon monoxide was still produced. Under difficult conditions, a large random variation of delay appears and was diminished by lowering injection pressure or adding 2% oil to the fuel. Performance was sensitive to chamber wall conditions. To lessen the delay, the Vigon procedure, i.e., injection of a little fuel near maximum compression of the evacuation stroke and generating reactive compounds by the next stroke, was chosen. Improved mixing in the chamber helped ignition at high power but led to incomplete combustion at low power. These factors can be used to predict progress in the design and operation of diesel engines.

6774

APTIC NUMBER 15116

Fainzil'ber, A. M. and N. A. Fridlender
OPTIMAL CONDITIONS FOR CHEMICAL REACTIONS IN GAS STREAMS. Brit. Chem. Eng., 12(7):1100-1101, July 1967. 3 refs.

The optimal conditions for a reaction in a gas stream flowing through a rectangular or cylindrical channel are analyzed by developing a non-linear system of differential equations. The result of the treatment, illustrated by reference to the combustion of CO to CO2 in a tube, is a procedure which allows the maximum rate of reaction to be determined.

6775

APTIC NUMBER 15275

Fedoseev, P. N.
ABSORPTION OF SULPHUR OXIDES WITH SILICATES. (Poglosh-cheniye okislov sery silikatami). Text in Russian. Zh. Analit. Khim., 13(1):123-126, 1958. 2 refs.

The absorption of sulfur dioxides was studied for the silicates of sodium, potassium, magnesium, calcium, strontium, barium, zinc, cadmium, aluminum, and lead. Quantitative adsorption was found to occur at 700-800 C with silicates of calcium, strontium, barium, and cadmium. Silicates of strontium, barium, cadmium, and calcium possess a low hygroscopic character. The silicates studied did not corrode quartz tubes at 700-800 C. Silicates of calcium, strontium, barium, and cadmium may be used for simultaneous quantitative determination of sulfur in organic substances together with determination of carbon and hydrogen.

6776

APTIC NUMBER 14593

Feldman, Fredric J., Robert E. Bosshart, and Gary D. Christian
SENSITIVITY OF MANGANESE DETERMINATION BY ATOMIC ABSORPTION SPECTROMETRY USING FOUR SOLVENTS. Anal. Chem., 39(10):1175-1177, Aug. 1967.

Organic solvents are often used to increase the sensitivity in atomic absorption analysis. Manganese has been extracted into methyl isobutyl ketone (MIBK) using ammonium pyrrolidine dithiocarbonate as the chelating agent. Instability of the complex and certain interferences make this procedure less than ideal. A study of the atomic absorption spectrometry of manganese in acetone, (MIBK), ethanol, and water is described. The concentration of manganese giving rise to a 5% relative absorption was 25, 1, 3, and 15 ppb for water, acetone, MIBK and ethanol solutions, respectively. Concentrations as low as 1 nanogram per ml can be detected using acetone, which appears to be the best solvent.

6777

APTIC NUMBER 13777

Ferguson, John B.
THE EQUILIBRIUM BETWEEN CARBON MONOXIDE, CARBON DIOXIDE, SULPHUR DIOXIDE, AND FREE SULPHUR. Proc. Nat. Acad. Sci., 3:371-374, 1917. 9 refs.

Knowledge of the equilibrium between CO, CO2, SO2, and S2 can make available the free energy of sulfur dioxide, a quantity indispensable to the study of the chemistry of the sulfur compounds. However, complex subsidiary reactions occurring at comparatively low temperatures render the ordinary stream methods of investigation useless, since samples cannot be obtained which have not been reacted after leaving the equilibrium chamber. By means of a semistream method, samples showing no evidence of such reactions were obtained from equilibrium mixtures at 1263 deg abs. Equations have been developed from them for calculating thermodynamic constants for the main equilibrium reaction, the free energy of the equilibrium approached from the CO-SO2 side, and the free energy of the equilibrium approached from the CO2-S2 side.

6778 APTIC NUMBER 16595

Flengas, S. N. and T. R. Ingraham
ELECTROMOTIVE FORCE SERIES OF METALS IN FUSED SALTS AND ACTIVITIES OF METAL CHLORIDES IN 1:1 MOLAR KCl-NaCl SOLUTIONS. J. Electrochem. Soc., 106(8):714-721, Aug. 1959. 18 refs. (Presented at the Electrochemical Society, Ottawa, Canada, Sept. 28-Oct. 2, 1958.)

The potentials of a series of metal-metal chloride systems in an equimolar mixture of molten potassium and sodium chlorides were measured against a silver-silver chloride reference electrode. An electromotive force series of metals at different temperatures was established for the 1:1 KCl-NaCl solvent. Experiments with a chlorine electrode showed that the solutions of silver chloride in the KCl-NaCl solvent were ideal, and hence, the deviations from ideality of the other chlorides in the solvent could be attributed directly to the formation of complexes in the melts. Three types of behavior was observed for the Mn-MnCl2, Zn-ZnCl2, Cr-CrCl2, Tl-TlCl, Cd-CdCl2, Fe-FeCl2, Pb-PbCl2, Sn-SnCl2, Co-CoCl2, Ni-NiCl2, and Cu-CuCl systems. Ideality, and positive and negative deviations from ideality, were observed. Activity coefficients were calculated. For metal chloride solution such as MnCl2, ZnCl2, and all the others for which the activity coefficents are less than unity, the formation of complexes can be postulated. Although the presence of finite complexes in melts was demonstrated by the measurements, it was reasonable that in ionic metals, there exists several intermediate states of aggregation between the so-called non-complexed ionic state and the type of finite complexes found in aqueous solutions. The values of the activity coefficients, and of other thermodynamic functions which characterize these complexes in solution, will depend entirely upon the definition of a non-complexed state. It is possible to obtain solutions with positive, negative, or zero deviation from ideality by regulating the composition of the solvent and temperature. It was concluded that what is thermodynamically an ideal state is not necessarily a non-complexed state.

6779 APTIC NUMBER 15990

Fox, Arthur L., Clyde O. Henke, and Cortes F. Reed
PURIFICATION OF HYDROCARBON-SULPHUR DIOXIDE-CHLORINE REACTION PRODUCTS. (Charles L. Horn, Minneapolis, Minn. and DuPont De Nemours (E.I.) and Co., Wilmington, Del.) U. S. Pat. 2,228, 598. 6p., Jan. 14, 1941. (Appl. June 30, 1938, 15 claims).

A process is described for purifying surface-active compounds formed by reacting hydrocarbons, sulfur dioxide, and chlorine and hydrolyzing the resulting product. The invention provides a method of removing water-insoluble oils from the emulsion obtained when hydrocarbons are treated with a gaseous mixture of sulfur dioxide and chlorine and the resulting product is hydrolyzed with a hot caustic alkali. The method is exemplified by the treatment of a hydrocarbon oil with a gaseous mixture of sulfur dioxide and chlorine in the presence of light until the oil gains a certain weight. This produce is hydrolyzed and neutralized with a caustic alkali solution. The crude product that is obtained is an aqueous emulsion of hydrocarbon sulfonates, unreacted hydrocarbon, chlorinated hydrocarbon, and salts. This material is purified by diluting with water or a water-soluble organic solvent and removing the water immiscible layer. Purification can also be accomplished by centrifuging without dilution, by extracting the water insoluble portions with a water insoluble organic solvent, by steam distillation, or by a combination of these processes. Many of the products prepared according to the invention have excellent foaming and cleansing properties. These products can serve as intermediates for preparing derivatives useful as plasticizers for paint, varnishes, corrosion inhibitors, gum solvents, extractants for the refining of gasolines and oils, insecticides, detergents, wetting agents, and rewetting agents. They may also be used to improve flotation processes of ores, pigments, coals, etc. and to break petroleum emulsions. Other uses include fungicides, mildew preventives, penetrating agents, and dust collecting agents.

6780 APTIC NUMBER 16451

Frejacques, C. and R. Galley
LESSONS LEARNED FROM THE FRENCH STUDIES AND REALIZATIONS OF THE SEPARATION OF URANIUM ISOTOPES. (Enseignements tires des etudes et realisations francaises relatives a la separation des isotopes de l'uranium). Text in French. United Nations, New York, Proc. U. N., Intern. Conf. Peaceful Uses At. Energy, 3rd, Geneva, 1964, p. 329-333. 3 refs.

The work carried out in the field of separation of uranium isotopes by gaseous diffusion and by ultra-centrifugation is reviewed. An economic appraisal of the various parameters affecting the cost of the gaseous diffusion process has been carried out and shows that only very large plants treating at least 10,000 tons of UF6 yearly, corresponding to programs of annual power capacities of about 4,000 megawatt (electrical), can secure an economically acceptable production of enriched U.

6781 APTIC NUMBER 16413

Frejacques, C.
SEPARATION OF ISOTOPES. (Separation des isotopes). Text in French. Energie Nucl. (Paris), 6(8):531-532, Dec. 1964.

Session 2/10 of the 3rd International Conference on the Peaceful Uses of Atomic Energy, held from Aug. 31 - Sept. 9, 1964, is reviewed with respect to isotope separation. The papers are divided into three categories: separation of uranium isotopes; production of heavy water; and separation of other isotopes. The small number of papers presented at this session is not suprising in view of the important military applications of the separation techniques. Occasional quotations are presented, together with the identification numbers of the individual papers involved.

6782 APTIC NUMBER 15809

Fuquay, James J.
METEOROLOGICAL FACTORS IN THE APPRAISAL AND CONTROL OF ACUTE

EXPOSURES TO STACK EFFLUENTS. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, 272-279. 13 refs.

A method was developed from theoretical and empirical considerations for use in meteorological control of stack effluent discharge rates, applicable to an appraisal of environmental hazards for both radioactive and toxic gases as they apply to chemical processing plants. Special attention was given to dilution within the stack due to addition of excess air; the relationship between the emission rate of the pollutant and the ultimate concentration of the pollutant was expressed in terms of a dilution rate factor which was defined so as to include the integrated effect of meteorological parameters, stack parameters, averaging time, aerodynamics, terrain, and position with respect to the source. The following elements were needed for the method: the emission rate; the maximum allowable concentration for various periods of time; and the permissible dilution rate factors. For a continuous process in which the rate of emission of the ensuing gas was controlled, the emission rate was regulated in keeping with the meteorological conditions occurring at the time. For a batch process, the control was based on forecast meteorological conditions was more restrictive due to forecasting and scheduling problems. Summaries of the percentage occurrence of the dilution rate factors can be used for estimating the effect of meteorological control on potential total process operating time. (Author summary modified)

6783 APTIC NUMBER 15430

Gadalla, A. M. M. and J. White
EQUILIBRIUM RELATIONSHIPS IN THE SYSTEM CuO-Cu2O-MgO. Trans. Brit. Ceram. Soc., 63(3):119-134, 1940. 7 refs.

Following similar studies on the systems CuO-Cu2O-SiO2 and CuO-Cu2O-Al2O3, phase equilibrium relationships in the system CuO-Cu2O-MgO were investigated as a function of temperature and oxygen pressure (0.21 to 1.0 atm) using a thermobalance. From the observed relationships, the existence of an extensive range of MgO-rich solid solutions which can contain both Cu(2+) and Cu(+) ions was established. An intermediate compound was shown to exist at a composition approximating 2CuO.MgO. No evidence was found or reported of the existence of the compound CuO.MgO. Two invariant points on the liquidus surface of the ternary diagram were located in terms of oxygen pressure, temperature and composition, and a diagram showing the sub-solidus relationships in the ternary system CuO-Cu2O-MgO was constructed. From the oxygen pressure/temperature relationships established for the monovariant transitions occurring in the solid state, expressions were derived, within the limits of accuracy of the experimental data, for the standard free energies of the corresponding reactions. Recent work indicates that this system may be of particular interest in the refractories field, since it has been found that attack by copper oxides is an important factor in the failure of magnesite refractories in copper anode melting-furnaces and copper converters. (Author abstract modified)

6784 APTIC NUMBER 14920

Gainer, J. L. and A. B. Metzner
DIFFUSION IN LIQUIDS - THEORETICAL ANALYSIS AND EXPERIMENTAL VERIFICATION. Am. Inst. Chem. Engrs.- Inst. Chem. Engrs. Symp. Ser., no. 6:74-82, 1965. 39 refs.

A cell model of the liquid phase which considers both the intermolecular force field and simple geometric effects is used to develop expressions for the energy barriers which a diffusing molecule encounters. These energy barriers may be estimated from a knowledge of the density, viscosity, and heat of vaporization of the fluid and, in turn, lead to expressions for the diffusivity. The diffusivities predicted by these expressions are compared with the results of new experimental measurements on systems chosen to extremize the influences of molecular structure, thermodynamic nonideality and viscosity level, as well as with available literature data. These comparisons lead to the following conclusions: in high viscosity systems, the present work appears to give predictions of the effects of viscosity level and of molecular structure which are approximately correct, the mean deviation being 18%; under the same conditions, the prior art usually fails to predict even the correct order-of-magnitude of these effects upon the diffusivity. In low viscosity systems, for which the prior art is largely satisfactory, the present model leads to predictions of comparable accuracy but requires no adjustable (empirical) parameters to achieve this goal. Several limitations remain. In the first place, the accuracies are such as to make further refinements desirable. Secondly, the available data need to be extended somewhat to be broadly inclusive. Finally, the evaluation of the force field and geometric parameters was carried out for systems in which the diffusing solute is also a liquid at the temperature level of interest. (Author summary modified)

6785 APTIC NUMBER 15828

Gal-or, Benjamin
DEVELOPMENT OF A TWO-PHASE CONTACTOR WITHOUT PRESSURE DROP. Am. Inst. Chem. Engrs. J., 12(3):604-605, May 1966. 8 refs.

A compact multistage contactor is described that effects gas-liquid contact without pressure drop. The unit comprises contacting compartments and a common shaft with multiple impellers. As a result of the impeller action, the gas is sucked from stage to stage through the openings provided in the trays. The impeller acts as an agitator for the dispersion and provides pumping for the gas. Thus, the gas is self-induced from the bottom of the vessel and is subdivided in each compartment into small size bubbles that are dispersed throughout the liquid phase. Consequently, the pressure drop across the liquid phase is eliminated and a negative pressure drop is established instead. By applying a vacuum at the top, the lower pressure at the bottom of the unit allows heat sensitive materials to be handled under lower temperature conditions. Use of stators with radial vanes causes a very high shear on the liquid and incoming gas, resulting in a very small and relatively uniform diameter of

bubbles with a high total surface area for diffusion. Experimental results with a one-stage unit show an average bubble size lower than the average size obtained with conventional gas-liquid contactors. This is due to high shearing rates produced between the impellor and stator and to a slight compression caused by hydrostatic pressure of the liquid bulk. Relatively high surface areas for mass and heat transfer provide an efficient contacting operation. Experiments also show that the equipment is useful for the contact of three phases: gas, liquid, and suspended solids.

6786 APTIC NUMBER 15267

Gambill, Wallace R.
PREDICT DIFFUSION COEFFICIENT, D. Chem. Eng., 65(11):125-128, June 2, 1958. 20 refs.

Mutual and self-diffusion coefficients of gases are discussed. Mutual diffusion coefficients of most binary gas systems are in the 0.05 to 1.0 sq cm/sec range for temperatures from 300-400 K. The simple kinetic theory of gases predicts qualitative behavior, i.e., diffusion is more rapid at high temperatures because of higher molecular speeds, and at low pressures because average intermolecular distances are greater and collisions are less frequent. Various theories of diffusion often differ in the predicted variation of diffusivity with the composition of the gas mixture. Three methods are reviewed: Hirschfelder's which uses the empirical Lennard-Jones potential energy function for spherical, nonpolar molecules to derive expressions for the equation of state and transport coefficients of pure gases and gas mixtures at low and moderate densities; Arnold's in which the equation for diffusivity is accurate when used with estimated force constants; and Gilliland's which is based on the hard-sphere model of the classical kinetic theory. In the multicomponent systems, the diffusivities are highly dependent on composition and are different for each component. A rigorous theory of multicomponent mixtures gives complicated expressions for diffusion coefficients in gases containing more than two components. A limiting case of diffusion is that of a substance diffusing through itself. Self-diffusion is somewhat artificial quantity and may be considered only as a limit of mutual diffusivity. Experimental measurements of self-diffusion necessitate the use of isotopic tracers or orthopara forms. Two methods of calculating self-diffusion coefficients are given. Reliable prediction procedures are often valuable in designing such mass-transfer processes as distillation, absorption, and extraction.

6787 APTIC NUMBER 15113

Gambill, Wallace R.
PREDICT LIQUID DIFFUSIVITIES. Chem. Eng., 65(13):113-116, June 30, 1958. 23 refs.

Empirical and semi-empirical methods for predicting liquid diffusivities are discussed. Methods are given for calculating diffusivity in dilute solutions of nonelectrolytes. The Stokes-Einstein method applies only when the diffusing molecule is large compared to molecules of the solvent in which it is diffusing. Wilke and Chang's method, based on the Eyring theory of absolute reaction rate and the Stokes-Einstein equation, applies specifically to dilute solutions (0.1 molar or less) of nonelectrolyte. Arnold's theoretical equation was derived by extending a modified kinetic theory of gases to liquids. It is limited to very dilute solutions and low-boiling solvents at 20 C. Othmer and Thakar's reference-substance correlation for estimating the diffusivity is recommended when the solvent considered is water. The Wilke Chang general correlation is considered superior in all other substances. Other miscellaneous methods are described but are not recommended. Five specific methods are given for extrapolating a known value of diffusivity at one temperature to other temperatures. An equation is also given for the diffusivity of concentrated nonelectrolytic solutions. Problems associated with calculating the diffusivity of electrolytes are also reviewed. For electrolytes, diffusivity initally decreases with solute concentration, passes through a minimum, and then increases at higher concentrations. Because of this, calculated liquid-phase diffusivities usually exceed experimental values determined at low but finite concentrations.

6788 APTIC NUMBER 14380

Ganz, S. N.
KINETICS OF ABSORPTION OF NITROGEN OXIDES BY SULFURIC ACID IN ROTARY ABSORBERS WITH A LARGE NUMBER OF REVOLUTIONS. (Kinetika absorbtsii okislov azota sernoy kislotoy v rotatsionnykh absorberakh s bol'shim chislom oborotov). Text in Russian. Zh. Prikl. Khim., 29(7):1018-1028, 1956. 5 refs.

Absorption of nitrogen oxides with 76 and 92% sulfuric acid in a high-rpm horizontal absorber was studied experimentally. The test absorber, designed to take advantage of bubbling, spray, and film absorption, is described in detail. The effectiveness of such absorbers for use in sulfuric acid production was demonstrated. Experimental data is used to determine rate coefficients for nitrogen oxide absorption as functions of disk rotation rate, volumetric gas flow rate, concentration of nitrogen oxides in the gas, sulfuric acid concentration, and temperature. These coefficients may be used for mechanical absorber design. It was established that with a highly turbulent regime, the absorption rate for an equimolar mixture of NO and NO2 exceeds the rate for NO2 alone but to a lesser degree than under conditions of film absorption.

6789 APTIC NUMBER 16276

Ganz, S. N. and I. E. Kuznetsov
THE DESIGN OF OPEN EQUAL-FLOW TOWERS WITH CENTRIFUGAL SPRAYERS. Intern. Chem. Eng., 5(4):653-656, Oct. 1965. 7 refs. (Also: Izv. Vysshikh Uchebn. Zavedenii Khim. i Khim. Tekhnol., 8(1):151, 1965).

Open towers with uniform gas velocities and bulk spraying of liquids are finding increasing application in heat- and mass-transfer processes. A general method of designing open spray towers with centrifugal spraying is proposed, and equations are

derived for computing power consumption, average drop diameter, and absorption coefficients for nitric oxide, hydrogen sulfide, and sulfur dioxide in Na2CO3 solution. The design techniques presented make possible the accurate determination of basic structural shapes and sizes of equipment. Spray densities of open spray equipment for various volumetric gas velocities are tabulated.

6790

APTIC NUMBER 15169

Garrett, G. A. and J. Shacter
EVALUATION OF ISOTOPE SEPARATION PROCESSES. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. D. C. Nier (eds.), New York, Interscience, 1958, Chapt. 2, p. 17-32. 12 refs.

Typical procedures are outlined for designing an isotope separation facility, starting with basic laboratory data on the process being considered, basic engineering cost data, and assumptions regarding production requirements. Such procedures give an indication of the chance of commercial application of a separation process and a basis for selection among competing processes. When the competition among processes is close, the basis for analysis is the process design of the practical cascade which results in minimum costs. Important factors affecting isotope separation cascade construction and operating costs for various processes are discussed, and it is shown how these factors influence the shapes of practical cascades, which may be appreciably different from those of 'ideal' cascades. For example, where the process economics are dominated by the costs which are proportional to the total interstage flow rates, the practical cascade shape will closely approximate that of the ideal cascade; if, however, these costs are relatively minor, the optimum cascade shape may be shorter and wider or longer and narrower than the ideal cascade. The method is applied to the chemical exchange process developed by Taylor and Spindel of Columbia University for the production of nitrogen-15, in which the major costs are the chemical costs, which are proportional to the maximum rather than the total interstage flow rate, and the practical cascade design tends to minimize this maximum flow rate, resulting in a long narrow cascade. (Author abstract modified)

6791

APTIC NUMBER 13407

Gehlen, Heinz
ON THE REACTION AND PROPERTIES OF NITRIC OXIDE AND ITS COMPOUNDS. II. STUDIES OF THE SALTS OF NITRIC OXIDE-SULFUROUS ACID. (Ueber Reaktionen und Eigenschaften des Stickoxyds und seiner Verbindungen, II. Mitteil.: Zur Kenntnis der Salze der stickoxyd-schwefligen Saeure.) Text in German. Chem. Ber., 65:1130-1140, 1932. 19 refs.

While the alkali salts of nitric oxide-sulfurous acid, e.g. K2SO4.N2O (2HONHSO3K plus 2KOH plus O yields K2SO4.N2O plus K2SO3 plus 3H2O), had been studied in detail, the corresponding heavy metal salts could not be obtained. Put the reaction between heavy metal salts and K2SO4.N2O yields double salts, some of which are described here. The salt K2SO4.N2O was prepared by the reaction of nitric oxide gas with potassium sulfite. A reaction of this alkali salt with zinc sulfate produced K4Zn(SO4,N2O)3. Similarly, K4Co(SO4,N2O)3, K4Mn(SO4,N2O)3, and K2Cd(SO4,N2O)2 were obtained. The colcration of aqueous solutions of these double salts indicates complex formation. Addition of sulfuric acid destroys the color, while K2SO4.N2O restores it. The decomposition temperatures were determined. The chemical analysis of the four double salts is briefly described. The thallium salt Tl2SO4.N2O, was also prepared. The absorption rates of nitric oxide on the sulfites of thallium, lithium, sodium and potassium were also studied, and no differences in the rates were found. The homologous compounds, i.e., the selenites and tellurites, cannot absorb nitric oxide in alkaline solution. It is proposed that the easy and complete decomposition of K2SO4.N2O be used for the preparation of N2O. Nitrous oxide was determined by the explosion method after mixing with hydrogen.

6792

APTIC NUMBER 15939

Gerburt, Ye. V., I. M. Gleykhengauz, B. T. Vasil'yeye, and V. V. Illariono
SEEKING CATALYSTS FOR THE OXIDATION OF SULFUR DIOXIDE WITH A REDUCED IGNITION TEMPERATURE. (Izyskaniye katalizatorov dlya okisleniya sernistogo angidrida s ponizhennoy temperaturoy zazhiganiya). Text in Russian. Sb. Statei Nauchn-Issled. Inst. Udobr. i Insektofung., 1963:36-42. 5 refs.

The increase in activity of vanadium catalysts at low temperatures through the addition of phosphoric acid is conditioned by the fact that, under these conditions, the vanadium is maintained in pentavalent form. It was proposed that oxides capable of forming heteropolyacids with vanadium pentoxide might serve as activators at low temperatures in like manner to phosphoric acid. The addition of phosphoric acid to standard vanadium catalyst with or without barium sharply increases catalyst activity at low temperatures (420 C). MoO3 and WO3 produce a similar effect, but all of these catalysts are unstable and lose their low-temperature activity after a time. Prolonged operation of catalyst activated with phosphoric acid results in reduced activity through gradual evaporation of P2O5.

6793

APTIC NUMBER 15410

Gerding, H. and J. Lecomte
THE INFRARED ABSORPTION SPECTRUM OF GASEOUS AND LIQUID SULFURIC ANHYDRIDE. (Das ultrarote Absorptionsspektrum von gasformigem und fluessigem Schwefelsaeureanhydrid). Text in German. Physica, 6(8):737-763, Aug. 1939. 29 refs.

The infrared absorption spectrum of gaseous and liquid sulfur trioxide in the 7 to 20 micron range was determined with the automatically recording Lasbert and Lecomte mineral salt spectrometer as well as with a Hilger spectrometer equipped with a potassium chloride prism. Gaseous SO3 was heated to 50 C and distilled into a container. When everything was prepared for measurement, the SO3 container was smashed so that the vapor could expand into the adjoining section of the apparatus. The liquid

SO3 was spread out in a thin layer of 0.01 to 0.1 mm between two 3 mm plates of mineral salt, potassium chloride or potassium bromide. The results showed that the molecule of gaseous SO3 has a flat symmetrical configuration of the D 3h type. The molecular vibrations have the frequencies 653, 1068, 1332, and probably 530 inverse cm. The results for liquid SO3 showed that it consists of various types of molecules interacting with surrounding molecules. The symmetry is considerably different from that of gaseous SO3. The oscillation frequencies are probably 530, 653, 1068, and 1378/1402 inverse cm. Comparison with the ion groups CO3 and NO3, whose lattice structure is likewise distorted, supports this. The exact symmetry was not determinable. It can be concluded that the prominent polymer is composed of three molecules of SO3 forming a ring. The ring, which consists of three sulfur and three oxygen atoms, is not flat and has the symmetry C 3v.

6794 APTIC NUMBER 16294

Gerlach, J., K. -F. Kantzer, and F. Pawlek
THE INFLUENCE OF SULFUR DIOXIDE-CONTAINING COMBUSTION GASES ON LIQUID COPPER. (Die Einwirkung schwefeldioxidhaltiger Verbrennungsgase auf fluessiges Kupfer). Text in German. Metall., 17(11):1096-1099, Nov. 1963. 15 refs.

The solubility of sulfur dioxide in liquid copper is dependent on the oxygen partial pressure. To study this relationship, 50 g of copper (purity 99.998%) was heated, and a cleaned and dried gas mixture of SO2 and N2 or CO2-CO-SO2 was pumped through the molten copper at a rate of 6 l/hr. Gas chromatograph was used for the analysis of the gases; helium was used as carrier gas with a flow velocity of 1.41 l/hr. Oxygen concentrations of less than 0.2% in the copper were determined by metallography; concentrations of more than 0.2% were determined by reduction with carbon monoxide at 1200 C. The experiments were conducted at 1100, 1200, and 1300 C and at various SO2 pressures. The reaction followed the equation 2 O + S yields SO2. The results showed that the solubility of SO2 in liquid copper follows the empirical formula 10gK equals 6520/T - 2.80 for various temperatures (T), rate constant K, concentration and constant SO2 (0.1%) in the gas phase. Computed equilibrium curves for 1100 and 1200 C and various SO2 contents were hyperbolas showing that the solubility of oxygen and sulfur in the copper is directly proportional to SO2 content. Comparison of the solubilities at the two temperatures showed that desulfurization is better accomplished at low temperatures. Equilibrium studies of copper and the CO2-CO-SO2 gas mixture at 1200 and 1300 C also showed that the solubility of oxygen and sulfur in copper increases at higher temperatures.

6795 APTIC NUMBER 15304

Gerlach, J., H. G. Kleist, and K. Hager
THE SPEED OF PHASE TRANSITION OF GASEOUS SULFUR DIOXIDE IN LIQUID COPPER. (Die Geschwindigkeit des Phasenuebergangs von gasfoermigem Schwefeldioxid in fluessiges Kupfer). Text in German. Metall. (Berlin), 19(11):1163-1167, 1965. 22 refs.

Experiments for determining the solution speed of sulfur dioxide in a copper melt were conducted in a vacuum apparatus consisting of a bulb-shaped reaction chamber. A certain amount of gaseous SO2 is passed over liquid copper. The SO2 quantity retained by the liquid copper can be determined by measuring the pressure drop in the gas phase. From the results, the diffusion constant for sulfur was computed to be 0.06 cm/sec and 0.013 cm/sec for oxygen. In practical terms, the results of these experiments show that in the copper refining process, all the sulfur from the SO2 discharged by the furnace is retained by the copper bath. If the furnace is fired with heavy fuel oil, the copper bath retains 18 g S/t Cu within five minutes. Even if the phase boundary is 0.005 cm thick and the sulfur enters by diffusion only, the sulfur content of the copper bath increases in 2 hrs by 10 g/t Cu. The collision efficiency was found to be 0.001.

6796 APTIC NUMBER 16465

Germet, D. V. and A. Khitun
EFFECT OF METAL OXIDE ADDITIVES ON THE ACTIVITY OF TIN-CHROMIUM CATALYST. (O vliyanii dobavok okisey metallov na aktivnost' stanno-khromovogo katalizatora). Text in Russian. Zh. Prikl. Khim., 8(8):598-605, 1935. 9 refs.

Addition of CaO, MgO, SrO, ZnO, Al2O3, Bi2O3, MnO2, NiO, CoO and CuO was found to reduce the catalytic activity of SO2 absorption by Cr2O3 - SnO2, addition of BaO and Fe2O3 to increase the activity. With the addition of oxides of alkaline earth metals, the retarding effect increases with a decrease in radius of the additive ion since it is accompanied by an increased deforming effect on the field of the basic catalyst. Both chemical and crystallographic addition of Al2O3 and Fe2O3 have very little effect on the activity of the basic catalyst: the first, with a smaller ion, has a retarding effect, the second, with a larger ion, has a somewhat enhancing effect over a limited temperature range. In the case of elements with atomic numbers 25-30, even numbered elements have much less retarding effect and hence deform the field of the basic catalyst to less degree than do the odd elements. Additives BaO and Fe2O3 should be given further study in connection with industrial applications.

6797 APTIC NUMBER 15865

PROCESS OF PURIFYING GASES, ESPECIALLY SYNTHESIS- AND FUEL-GASES. (Gesellschaft fuer Linde's Eismaschinen A G, Hollriegelskreuth, Germany and Lurgi Gesellschaft fuer Waermetechnik, Frankfurt, Germany) British Pat. 734,577. 2p., Aug. 3, 1955. (Appl. Dec. 7, 1951, 2 claims).

An improvement in the washing liquid used in a process for purifying and scrubbing gases is reported. The process, described in a co-pending application, consists of purifying gases derived from synthesis, cracking, and hydrogenation by washing and cooling the gases with a polar washing agent below 0 C and at least 2 atm. The polar washing liquids, which consist of oxygen- or nitrogen-containing organic compounds, are listed. These liquids will remove ammonia, hydrogen sulfide, and carbon dioxide from gases.

6798 APTIC NUMBER 15502

Giber , Rene
CONDITIONS FOR THE POSSIBILITY OF ISOTOPE ENRICHMENT BY A PHOTOCHEMICAL REACTION. (Conditions de possibilite de l'enrichissement isotopique par une reaction photochimique). Text in French. J. Chim. Phys., 60(2):205-208, 1963. 9 refs.

The possibility of selective excitation by radiation of a single molecular species in a mixture and the effect of the vibrational energy on the rate of an intermolecular reaction are analyzed. By consideration of simple conceptual models of radiative excitation of a diatomic molecule under stationary conditions and a reaction between a monatomic and a diatomic molecule in equilibrium at the radiation temperature, two analytical expressions are derived. The following conclusions are drawn: 1) The first expression shows that the irradiation of a gas mixture by an appropriately chosen method effects selective excitation of the vibrations of a single molecular species in an isotope mixture; and 2) The considerable effect of the vibration temperature on the reaction rate, evidenced by the second expression, shows that it is possible to attain high separation factors with relatively slight temperature differences. Such an effect, in which the absorbed energy influences the reaction rate through the intervention of the vibration temperature of the molecule, cannot be properly called photochemical, but rather photothermal.

6799 APTIC NUMBER 13399

Gierer, Josef and Bernard Lenz
REACTION OF LIGNIN DURING SULPHATE COOKING. PART 6. FORMATION OF 1,2-GLYCOL GROUPS IN MILLED WOOD LIGNIN ON TREATMENT WITH 2N SODIUM HYDROXIDE AT 170 C. Svensk Papperstid. (Stockholm), 68(9):334-338, May 15, 1965. 16 refs.

The reliability of a proposed splitting mechanism for alkaline cleavage of arylether bonds was experimentally proved by demonstrating the presence of 1,2-glycol groups in alkali lignins and by estimating the frequency of these groups. Milled wood lignin (MWL) from Picea abies was treated with 2N sodium hydroxide at 170 C for 3 hrs. Two samples of the resulting alkali lignin, one of which had been subsequently methylated with diazomethane were oxidized with periodate. The consumptions of periodate, compared with those of treated and untreated diazomethane-methylated milled wood lignin indicated that 1,2-glycol groups (0.13 per methoxyl, originally present) are formed during the alkaline treatment. The presence of 1,2-glycol groups in alkali lignin was also supported by showing that carbonyl groups are formed on periodate oxidation of borohydride-reduced, diazomethane-methylated, alkali-treated milled wood lignin (IR spectrum and estimation by the hydroxylamine method). The results are consistent with the view that beta-arylether linkages in non-phenolic lignin units containing a free hydroxyl group at a neighboring carbon atom of the side-chain are split via the corresponding epoxy intermediates into 1,2-glycol structures. (Authors' abstract modified)

6800 APTIC NUMBER 15805

Gilbert, Everett E.
THE REACTIONS OF SULFUR TRIOXIDE, AND OF ITS ADDUCTS, WITH ORGANIC COMPOUNDS. Chem. Rev., Vol 62:549-589, 1962. 558 refs.

The reactions of sulfur trioxide and its organic complexes are reviewed with respect to organic compounds through 1960. The preparation and properties of the following complexes are explained: pyridine, dioxane, trimethylamine, triethylamine, dimethylaniline, thioxane, bis(2-chloroethyl)ether, 2-methylpyridine, quinoline, and dimethylformamide. Reactions with aliphatic and alicyclic compounds are described as with either saturated compounds (hydrocarbons, halogenated hydrocarbons, carboxylic acids, esters, nitriles, ketones aldehydes, alcohols, sterols, glycols, polyether glycols, polyether alcohols, carbohydrates, nitrogenous polysaccharides, ethers, amines, amides, amino acids, proteins, oximes, and hydroxylamines) or with unsaturated compounds (alkyl and aryl ethylenes, cycloalkenes, halogenated ethylenes, vinyl ethers and esters, ketones and aldehydes, alkenoic acids, alkadienes, cycloalkadienes, alkynes, alkenols, and alkynols). Reactions with aromatic compounds are grouped as benzene derivatives (benzene, toluene the xylenes, petroleum oils, polystyrene, halogenated benzenes and alkylbenzenes, amines and anilides, phenolic compounds, aminophenols, mono- and dicarboxylic acids and related compounds, sulfonic acids, nitro compounds, and halosulfonation reactions); naphthalene derivatives (hydrocarbons, naphthylamines, naphthols, and aminonaphthols); and reactions with heterocyclic compounds (furan derivatives, thiophene derivatives, pyrrole and indole derivatives, pyridine, and alkyl pyridines).

6801 APTIC NUMBER 15125

Gilliland, E. R., M. F. Haddour, and R. H. Engel
FLOW OF GASES THROUGH POROUS SOLIDS UNDER THE INFLUENCE OF TEMPERATURE GRADIENTS. Am. Inst. Chem. Engrs. J., 8(4):530-536, Sept. 1962. 34 refs.

The isothermal and isobaric flow of pure gases and vapors through microporous Vycor glass was investigated under such conditions that the gas-phase flow occurred by Knudsen diffusion. The isothermal flows and the isobaric flow of nonadsorbed gases are correlated by existing relationships. On the assumption that surface flow is a diffusive process and that equilibrium exists between the vapor and solid throughout the porous media, a correlation for the nonisothermal surface flow is developed. The factors determining the rate of surface flow are the physical properties of the solid, the temperature level and gradient, the enthalpy of adsorption, the surface concentration and spreading pressure of the adsorbed phase, and the activation energy and coefficient of resistance for surface diffusion. The latter two factors can be evaluated from isothermal surface flow measurements; hence no new arbitrary constants are required in the correlation. Agreement between predicted and measured surface flows is good for ethylene and propylene at a mean temperature of 25 C. Both the gas-phase and surface flows are from the cold to hot end of the porous solid. It is suggested that the use of

temperature gradients in porous solids and plastic films for separating mixtures of vapors be investigated. (Author abstract)

6802 APTIC NUMBER 14873

Glasson, D. R.
REACTIVITY OF LIME AND RELATED OXIDES. XVI. SINTERING OF LIME. J. Appl. Chem. (London), 17(4):91-96, April 1967. 8 refs.

Calcium carbonate samples containing known amounts of additives and impurities were calcined in air at a series of temperatures for different lengths of time. Changes in specific surface and average crystallite size show the effect of the additives and impurities (accessory minerals in limestones and chalks) on the lime sintering. Salt and calcium sulfate each accelerate lime sintering between 800 and 1100 deg. The presence of the chloride during the carbonate decomposition affects the subsequent surface activity and sintering behavior of the lime. Added phosphates have comparatively little influence on lime sintering at 800, 900 or 1000 deg. When lime separates from the decomposition of carbonato-apatites, the phosphate recrystallizes to fluor-apatite and sinters. Ferric oxide progressively increases lime sintering at 800, 900, 1000 and 1100 deg. Like anhydrite, its low Tammann temperature (650 deg) readily permits ion diffusion into lime cracks and fissures, promoting sintering. Alumina, with a higher Tammann temperature (890 deg), appreciably enhances lime sintering only above 1100. The comparatively low Tammann temperature of silica (730 deg) does not, however, lead to greatly increased lime sintering below 1100 deg, probably because of formation and separation of calcium silicates with higher Tammann temperatures similar to that of alumina. (Author abstract modified)

6803 APTIC NUMBER 15432

Glaubitz, F.
THE ECONOMIC COMBUSTION OF SULFUR-CONTAINING HEATING OIL. A MEANS OF AVOIDING DEW POINT DIFFICULTIES IN BOILER OPERATION. Combustion, vol. 34:31-35, Jan. 1963. (Presented at a meeting of the work group 'Oil Furnaces' of the VGB, Graz Austria, May 2, 1960.) (Also: Mitt. Ver. Grosskesselbesitzer, no. 68, Oct. 1960.)

Because of furnace and air heater difficulties due to temperatures lower than the dew point at a refinery in Lingen, Germany, the oil burner was redesigned so that sulfur dioxide rather than sulfur trioxide was formed from the combustion process for the purpose of preventing corrosion (since the dew point of flue gases is raised only by sulfur trioxide; on the other hand, sulfur dioxide causes no increase). In the redesigned oil burner, air is added in the middle and distributed in such a way that the oil burner is not blown out. A greater part of the air is passed into the atomized oil with a fair velocity through the ring space. The air stream does not rotate around the burner but is passed in parallel to the burner axis. As a result, good combustion is obtained. However, the feed to the oil burners in the furnace walls was nonuniform, due to inadequate burner nozzles and differently abraded pipes. After adjustments, regulation to at least 1:8 was obtained. When the air was throttled up to 0.5% oxygen, the dew point was approximately 110 C with the greatest deposit velocity at 70 C. When pressure-fired oil furnaces were installed with the newly designed burners, dew points of 48 to 52 C could be determined for an air excess of 0.2% oxygen for a flue gas temperature of 250 to 300 C.

6804 APTIC NUMBER 15421

Glemser, O., M. Fild, and K. Kleine-Weischede
A STUDY OF THE SOLUBILITY OF LITHIUM NITRIDE, CALCIUM NITRIDE AND CALCIUM SULFIDE IN MOLTEN SALTS. (Ueber die Loeslichkeit von Lithiumnitrid, Calciumnitrid und Calciumsulfid in geschmolzenen Salzen). Text in German. Z. Anorg. Allgem. Chem., 332:257-262, 1964. 15 refs.

Nitrides of lithium and calcium were prepared according to Zintl method, the calcium according to the Brauer method. The Li3N was obtained by melting lithium in presence of paraffin and heating it to 600 C in a nitrogen atmosphere. The salts were melted in an apparatus devised by Barber and Sloan and, subsequently, the substance to be dissolved was added in large lumps. After two to three hours, the fraction of nitrogen or sulfur in the melt was analytically determined. The studies primarily concentrated on the system LiH-LiF-LiCl. Of the pure salts, only LiCl was used. The melting point of the ternary system was 454 C; its composition was 76% by weight LiCl, 19% LiF, and 5% LiH. In all cases, lithium salts turned out to be good solvents. The solubility of a substance such as Li3N depended on the size of the anions and cations of the solvent. Melts with the same cation showed a decreasing solubility with increasing anion; at the same anion (chloride), solubility decreased with increasing cation. Comparison of various substances dissolved in the same solvent shows that calcium nitride is much less soluble than Li3N.

6805 APTIC NUMBER 15422

Gleu, Karl and Karl Rehm
LUTEO AND PURPUREO SALTS OF RUTHENIUM. RUTHENAMMINES. I. (Luteo- und Purpureosalze des Ruthenium. Ruthenammines. I). Text in German. Z. Anorg. Allgem. Chem., 227(3):237-248, 1936. 3 refs.

Three-valent ruthenium forms complex ammines with a coordination number of 6. The basic hexammine and pentammine series of three-valent ruthenium are described. They are the luteosulfate (Ru(NH3)6)2(SO4)3.5H2O, the acid luteosulfate (Ru(NH3)6)SO4.SO4H, the chloropurpureobromide (Ru(NH3)5Cl)Cl2, and the bromopurpureobromide (Ru(NH3)5Br)Br2. Proof of the three valency of ruthenium in these compounds is seen in the following facts: the compounds are analogous to the corresponding compounds of cobalt and chromium; the analytically determined hydrogen content of the purpureochloride excludes any formula other than the one given; and the magnetic properties of these ruthenammines

agree with theory. The compounds are paramagnetic with one mole moment of about 2 Bohr magnetones. The colorless basic ruthenammines easily change to deeply colored compounds which can be reversibly oxidized and reduced. They can thus be used as redox indicators. It is very likely that all elements from the chromium to the cobalt groups are basically able to form such ammines.

6806 APTIC NUMBER 16079

Glukhov, S. A.
THEORY AND DESIGN OF EJECTION-TYPE ATOMIZER. Med. Tekhn., Nov.-Dec. 1968:20-26, 7 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C., JPRS 47395, 12p., Feb. 6, 1969.

Theoretical and experimental data are presented for the parameters affecting the process of liquid atomization by ejection-type atomizers used in aerosol therapy. Equations are given for calculating working air pressure, air flow rate, efficiency, mean mass radius of the aerosol particles, and the flow rate of atomized liquid. The working air pressure in front of the atomizer is one of the most important parameters determining the operation of an atomizer. By varying the air pressure, the flow of air from the atomizer to a patient's lungs can be kept within the value necessary for minute ventilation. The mean mass radius determines the penetration of aerosols to the lungs and their retention there. It decreases with an increase in the relative velocity of air flow and effluent liquid jet and with a decrease in the radius of the liquid nozzle. Atomizer efficiency increases with a decrease in the density of the sprayed liquid. Therefore, to avoid errors in determining efficiency or the dose of medicine to be introduced into lungs, the sprayer must be calibrated for different medicines. A mathematical model for an atomizer design is included.

6807 APTIC NUMBER 16470

Goksoyr, H. and K. Ross
THE RELATION BETWEEN ACID DEWPOINT AND SULPHUR TRIOXIDE CONTENT OF COMBUSTION GASES. Shell Research Ltd., Chester, England, Thornton Research Centre, Report M.219, 22p., May 1962. 10 refs.

The relationship between the acid dewpoint and the sulfur trioxide content of combustion gases was established. Dewpoint measurements were carried out on flue gases containing 15% v water vapor and sulfur trioxide contents of 7 to 50 ppm by the saturation method, an electrical dewpoint meter, and a chemical dewpoint probe. The experimental results were compared with corresponding theoretical data. It was concluded that the relationship between dewpoint and sulfur trioxide-water vapor contents could be calculated by Mueller's method. The method developed for deriving this relationship experimentally was satisfactory. The results obtained agreed well with those deduced by Mueller. The electrical dewpoint meter indicated the dewpoint with only a limited amount of accuracy. It was affected by adsorption of acid at temperatures above the true dewpoint and also by cooling of the thermocouple leads. The most dependable way of using this meter is to determine the true probe temperature giving a zero rate of acid build up. The chemical dewpoint probe can be used to indicate the temperature range in which corrosion may occur. Its accuracy for determining dewpoints was also affected by acid adsorption. (Author summary modified)

6808 APTIC NUMBER 16099

Goliath, Marit and Bengt O. Lindgren
MECHANISM OF REDUCTION OF SULPHUR DIOXIDE BY FORMIC ACID. Acta Chem. Scand., 16(3):570-574, 1962. 11 refs.

A detrimental by-reaction of the sulfite pulp cooking process is the reductio of sulfur dioxide to thiosulfate by monosaccharides and other components of the waste liquor. A simple substance in the liquor that can cause this reaction is formic acid. An examination of the bisulfite-formic reaction was carried out at 135 C in solutions whose pH ranged from 1.5 to 8 and followed by a determination of the thiosulfate and bisulfate concentration of the reaction products. The results show that the reaction is of the second order, with the rate proportional to the concentrations of both bisulfite and formate ions. The reaction proceeds most rapidly in solutions having a pH 2-3 at room temperature. A four step path is suggested for the reaction, which is assumed to involve an oxidation of HCOO(-) by SO2.

6809 APTIC NUMBER 15834

Gomes, A. and M. M. Joullie
CYCLOADDITION OF KETEN AND IMINES TO SULPHUR DIOXIDE. Chem. Commun., no. 18:935-936, 1967. 6 refs.

Liquid sulfur dioxide was used as a solvent in a study of the reactions of ketene with imines to obtain azetidinones. However, instead of the expected azetidinones, products of sulfur dioxide were isolated in good yields. These structures result from what appeared to be a novel cycloaddition reaction of sulfur dioxide. Analytical and physical data indicated that both compounds contained a sulfur group. This cycloaddition may proceed through a concerted mechanism or through the reaction of a 1,4-dipole intermediate formed from ketene and the imine with sulfur dioxide. The latter course seems more probable since the reaction appears to yield only one product and ketene is known to react with imines in the absence of sulfur dioxide.

6810 APTIC NUMBER 13489

Gordon, A. R.
THE FREE ENERGY OF SULPHUR DIOXIDE. J. Chem. Phys., 3(6):336-337, June 1935. 25 refs.

The heat of formation of SO2 from diatomic sulfur and oxygen was calculated from the calorimetric heats of formation of sulfur dioxide and hydrogen sulfide. The free energy for SO2 formation at 289.1 K was determined. Equilibrium constants for the reactions 1/2S2(g) +O2 = SO2, and SO + 1/2O2 = SO2 are

tabulated for the range 298.1 to 2800 K. (Author's abstract modified)

6811 APTIC NUMBER 15067

Gorelik, L. I., Yu. N. Redkoborodyi, and V. V. Sinitsyn
INFLUENCE OF A MAGNETIC FIELD ON THE THERMAL CONDUCTIVITY OF GASES WITH NONSPHERICAL MOLECULES. Soviet Phys. JETP (USSR) (English translation from Russian of: Zh. Eksperim. i Teor. Fiz.), 21(2):503-505, Aug. 1965. 12 refs.

It was shown earlier that the transport coefficients (viscosity and thermal conductivity) of nitrogen depend on the magnetic field. It was suggested that this effect is due to both the nuclear and rotational magnetic moments of nitrogen. A comparison of this effect in nitrogen with the corresponding effect in oxygen confirmed the validity of the suggestion and made it possible to establish the effective magnetic moment of nitrogen. The present work reports briefly on the results of investigations of this effect in N2, CO, CO2, N2, and D2. The average values of rotational magnetic moments together with the data on the nonsphericity of these molecules, are given. The measurements were carried out at room temperature at pressures of 0.06-1.0 mm Hg and in the fields to 3200 Oe. Final conclusions about the accuracy of the theory for N2, CO, and CO2 cannot be made due to the lack of experimental data of the rotational magnetic moments of these molecules. However, the comparison of data of the rotational magnetic moments for N2 and D2 show that the theory developed for molecules of the N2 type is approximately correct. After refinement of the theory for H2 and D2, it should be possible, depending on the degree of agreement of this theory with the experimental results, to answer the question about the limits of the applicability of the theory to other gases.

6812 APTIC NUMBER 16395

Gorelik, L. L. and V. V. Sinitsyn
INFLUENCE OF A MAGNETIC FIELD ON THE THERMAL CONDUCTIVITY OF GASES WITH NONSPHERICAL MOLECULES. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i. Teor. Fiz.), 19(1): 272-273, 1964. 8 refs.

The influence of a magnetic field on the thermal conductivity of N2 was investigated at a pressure of 0.035 mm Hg in fields up to 340 oersteds. Experimental apparatus consisted of two interconnected chambers in which electrically heated platinum wires were stretched. These wires formed two arms of a Wheatstone bridge. A microvoltmeter was connected across the bridge diagonal. The change of thermal conductivity was plotted against H/p, where H was the magnetic field and p was the pressure. The resultant curve, showing the relative dependence of thermal conductivity on H/p, was similar to the viscosity curve given by Beenakker et al, who suggested that the magnetic field should affect transport processes of all the diatomic gases due to the nonsphericity of their molecules and their nuclear and rotational magnetic moments.

6813 APTIC NUMBER 15026

Gorelik, L. L.
OXYGEN GAS ANALYZERS USING THE VARIATION OF THERMAL CONDUCTIVITY OF OXYGEN IN A MAGNETIC FIELD. Zh. Tekn. Fiz., 33(12):1459-1461, Dec. 1963. 5 refs. Translated from Russian in: Soviet Phys.-Tech. Phys., 8(12):1084-1086, June 1964.

The development is reported of oxygen gas analyzers which make use of the change in thermal conductivity of oxygen and which are extremely sensitive at very low operating pressures. A device intended for periodic analysis of oxygen is characterized by periodic switching of the magnetic field, operating pressures of 0.05-0.3 mm Hg, a small constant magnetic field produced by a solenoid, and the orientation of platinum wires along the magnetic field. Provisions for increasing the thermal asymmetry of the transducer permit measurements of the total pressure of gas mixtures from 0.4-10 mm Hg. An analyzer is also available for the simultaneous monitoring of five different points. Here five transducers are connected by a sequential switching system to one control unit. A differential transducer allows differential measurements of oxygen from 20-20%. In contrast to most magnetic gas analyzers, the sensitivity of the analyzers described is essentially independent of the range of variation of the components that are not being measured.

6814 APTIC NUMBER 14853

Gorodinskii, S. M., L. S. Es'kova-Soskovets, A. F. Kobylkin, V. S. Sarychev, and E. A. Fishevskaya
ULTRASONIC AEROSOL GENERATOR. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 29(6):655-659, Nov.-Dec. 1967. 12 refs.

Construction of an ultrasonic generator for the production of radioactive aerosols is reported. Production of a nearly monodisperse aerosol, the possibility of feeding the generator with a solution of predetermined activity for production of a given concentration of radioactive aerosol in the chamber, high output, and convenient use were the main design requirements. The generator operates at frequencies of 0.8 and 2.4 MHz with a ceramic piezoelectric element. The output rate is four times that of a generator using barium titanate and remains stable for a long period. The aerosols were nearly monodisperse. Sixty percent of the particles produced 0.35-0.45 microns. The aerosol is bipolarly charged; the average charge is 5 electrostatic units. The generator has applications for physicochemical and biological investigations of ways to protect individuals from air contaminated by radioactive materials. It can also be used in the field of inhalation therapy and for the calibration of radiometric equipment.

6815 APTIC NUMBER 15185

Gose, Earl E.
ON THE SEPARATION OF GAS MIXTURES IN A JET. Am. Inst. Chem. Engrs. J., 6(1):168-170, March 1960. 2 refs.

The components of a gas mixture can be separated by allowing a jet of the gas mixture to expand in a low-pressure chamber. The heavier molecules will concentrate near the center of the jet and the lighter ones near the edge. Thus, the jet can be split into two streams, one containing the heavy component and one containing the light component. The prediction of this effect from the kinetic theory of gases is discussed. According to this theory, the velocity distribution of one component of a gas mixture is unaffected by the presence of the other components. It was assumed that the gas in the feed tube has a Maxwell-Boltzmann distribution of velocities superimposed on the mean bulk-gas velocity, that the jet is axially symmetric, and that collisions between molecules in the low-pressure region may be neglected. The predicted magnitude of the effect agrees favorably with published experimental data. For the separation of isotopes of uranium hexafluoride, the predicted enrichment factor for jet separation is larger than the value commonly used for the process of barrier effusion. This indicates that jet separation should be given serious consideration for separations of this type. One advantage of jet separation is the extreme simplicity of the apparatus. This would allow construction and maintenance costs to be kept very low.

6816 APTIC NUMBER 16503

Gregory, S. A.
OPPORTUNITIES, TECHNICAL AND ECONOMIC, FOR THE DIRECT USE OF ELECTRICITY AND ALLIED FORMS OF ENERGY FOR UNIT OPERATIONS AND PROCESSES: SOME REFLECTIONS. Trans. Inst. Chem. Engrs. (London), vol. 44:329-335, Dec. 1966. 55 refs. (Presented at a symposium of the Midlands Branch of the Institution on Electrical Power and Chemical Engineering, Birmingham, April 5-6, 1966.)

The significance of electrical and allied forms of energy for a number of actual and potential chemical processes is comparable with that of material feedstocks. These forms of energy are utilized in direct thermal processes represented by plasma jets, arcs, and self-resistive fluidized beds; ionization radiation with electron accelerators or isotopes; photocatalysis; corona discharge; solution electrodes; mass transfer by the application of fixed or variable beds; specialized heating by radio-frequency and microwave; and direct thermal processes without electricity. Of special interest to air-pollution control is the corona discharge process the suggested applications of which include water purification, recovery of chemicals from coal, desulfurization of heavy fuel oil, and polymer coatings for steel. If a suitable process could be developed, it is possible that the self-resistive fluidized bed may one day be used to recover carbon disulfide from sulfur, hydrogen sulfide, and hydrocarbons and hydrocynaic acid from ammonia and hydrocarbons. At the present time, self-resistive fluidized beds suffer the same limitations as other electrothermal techniques.

6817 APTIC NUMBER 16182

Guss, L. S. and I. M. Kolthoff
THE BEHAVIOR OF SULFUR DIOXIDE AS AN ACID IN METHANOL. J. Am. Chem. Soc., vol. 66:1488-1488, Sept. 1944. 16 refs.

The conventional dissociation constant of sulfur dioxide in methanol was determined colorimetrically with acid-base indicators and by conductance measurements of solutions of sulfur dioxide in methanol. The dissociation constant of sulfur dioxide was 3 times 10 to the minus seventh power or pKa equals 6.5. Because the dissociation constants of sulfur dioxide in water and in methanol are apparent constants, the reaction between water and sulfur dioxide to form sulfurous acid must be of the same order of magnitude as that between methanol and sulfur dioxide. The acidity of methanol solutions of sulfur dioxide is due to the monobasic acid CH3OSO2H which gives no indication of acting as a Lewis acid with the basic form of thymol blue. The conclusion that sulfur dioxide in methanol behaves as a conventional acid is supported by the fact that the association constant values calculated from colorimetric data seemed independent of the sulfur dioxide concentration. The value of the association constant also agrees with those obtained conductometrically, the conductance being unaffected by a Lewis acidity of sulfur dioxide. Therefore, the acidity of methanol solutions is due to the formation of the methyl ester of sulfurous acid. The addition of small quantities of water to methanol solution of sulfur dioxide results in the transfer of protons from methanol to water without affecting other equilibria.

6818 APTIC NUMBER 16119

Gussman, Robert A.
ON THE AEROSOL PARTICLE SLIP CORRECTION FACTOR. J. Appl. Meteorol., 8(6):999-1001, Dec. 1969. 9 refs.

The slip correction factor for equations of particle motion is discussed. The fact that the constants are empirical, and that the values used are specifically for an air/oil droplet system are not usually considered, even when very different atmospheres and aerosols are under investigation. Fuchs and Stechkina developed a completely theoretical expression for the mobility of a particle in a gas. As the particle diameter becomes small, a correction is required for slip. The physical basis for this correction is laid on the assumption of a limiting sphere surrounding a particle whose shell thickness is approximately equal to the mean free path of the molecules. The transfer of momentum within the sphere is assumed to be according to the laws of kinetic theory of gases and outside the sphere, by the laws of hydrodynamics for a viscous fluid. The theoretical expression requires only the measurement of the percentage of gas molecules reflected diffusely from the particle. The development is presented in a simplified form and its use is encouraged as a direct replacement for the Cunningham correction factor.

6819 APTIC NUMBER 16573

Hall, Henry
THE SYSTEMS AG-SB-S, AG-AS-S, AND AG-BI-S: PHASE RELATIONS AND MINERALOGICAL SIGNIFICANCE. Brown Univ., Providence, R. I., Dept. of Geology, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1969, 172p. 108 refs.

A description of minerals, and a discussion of previous experimental studies, experimental methods, chemistry of group 5a elements, various binary systems, polybasite-pearceite, proustite-pyrargyrite, thermodynamic considerations, and experimental results are presented. It is only with a full knowledge of the composition limits of compounds and what compounds are stable that one can discuss the origin of sulfide deposits. Work on the systems Ag-Sb-S, Ag-As-S, and Ag-Bi-S was undertaken. Each of the elements in the group 5a has a pair of s electrons and three p electrons beyond a rare gas configuration. These systems have been investigated by previous workers, but the data are incomplete and not always in agreement. Data available for the Ag-As-S system are restricted to the joint Ag S-As S; and only at relatively high temperatures. Most previous observers investigated the system at temperatures above 300 C and did not consider compositions with more sulfur than along the joint Ag S-Sb S. In order to investigate polymorphic changes in some phases other techniques were used, such as the high temperature X-ray camera and differential thermal analysis. Specially constructed silica-glass tubes were also used as containers for samples studied by differential thermal analysis. Some phases were difficult to identify optically and iridescent filming of the polished section was found to be useful. Details as to the stereochemistry of the As, Sb, and Bi sulfides are described. Experimental data on the three binary systems are presented.

6820 APTIC NUMBER 15781

Hamberg, Marvin
A USER LOOKS AT BRAZED ALUMINUM PLATE-FIN EXCHANGERS. Proc. Am. Petrol. Inst., Sect. III, vol 43:180-194, 1963. 5 refs.. (Presented at the American Petroleum Institute, Division of Refining, Midyear Meeting, 28th, Philadelphia, May 13, 1963.)

The early history, construction, and manufacture of brazed aluminum plate-fin exchangers are described. Advantages include ease of manufacturing, the ability to handle many different fluid streams with a variety of flow patterns, and a structure free of joints. Disadvantages include difficulty in cleaning the units, difficulty in accurately locating and correcting internal leaks between passes in the field, limited applications to process media that are not corrosive to aluminum, and the necessity of protecting low-melting point aluminum material from fire hazard. Typical petroleum chemical processes which utilize fin exchangers are air separation plants used for the production of nitrogen and oxygen, helium extraction from natural gas, hydrogen purification and liquefaction, ethylene recovery and production plants, natural gas liquefaction, and cascade refrigeration. Applications were also made in the aircraft, transportation, electronic, and missile industries. Most of the applications were in the cryogenic field. Two typical processes utilizing this equipment were explained. They were an air separation plant and a cascade refrigeration system. Unusual operating and maintenance experiences were discussed. The durability and dependability of plate-fin exchangers for long-term, continuous-process applications were demonstrated. These multistream exchangers were shown to be highly efficient, operating on very close temperature differences. They provide more heat transfer surface per cubic foot of volume than any other known type of exchanger. Economic advantages were presented which show that this type of exchanger provides the lowest cost per square foot of heat transfer surface for initial plant investment and daily operating expense in low-temperature petrochemical processes.

6821 APTIC NUMBER 15961

Hanhart, J., H. Kramers, and K. R. Westerterp
THE RESIDENCE TIME DISTRIBUTION OF THE GAS IN AN AGITATED GAS-LIQUID CONTACTOR. Chem. Eng. Sci., 18(8):503-509, 1963. 5 refs.

The residence-time distribution of gas passing through a 60-cm gas-liquid reactor with a four-blade agitator and four six-blade turbine impellers was investigated by introducing a step-wise change in the composition of feed gas entering the vessel and recording with a thermal conductivity cell the composition of the outgoing gas as a function of time. The step-wise change was made by passing from air to a mixture of 90% air and 10% hydrogen. The residence time was measured for shaft rotation speed, gas load, impeller diameter, and agitator height. It was found that in the region where the agitation is effective (rotational speed of the agitator shaft is greater than the minimum value of rotational speed for agitation effect), the residence time distribution resembles that of a perfect mixer. Consequently, in a gas absorption process where the rate of absorption of a gas component is proportional to its concentration in the gas, the driving force for the absorption has to be based on the composition of the gas leaving the dispersion.

6822 APTIC NUMBER 16249

Hardy, R. W. F. and E. Knight, Jr.
REDUCTION OF N2O BY BIOLOGICAL N2-FIXING SYSTEMS. Biochem. Biophys. Res. Commun., 23(4):409-414, May 1966. 18 refs.

Nitrous oxide was reduced to nitrogen by N2-fixing extracts of A. vinelandii and C. pasteurianum. The substrate requirements and extract dependency of the reduction were identical to those for nitrogen fixation and reductant-dependent adenosine triphosphatase or ATP-dependent H2 evolution. This suggests that the reduction of nitrous oxide is catalyzed in part by enzymes of the N2-fixing system and that electrons activated by the reductant-dependent ATPase of the N2-fixing complex are utilized for N2O reduction. These conclusions are support by the following observations: N2O did not affect electron activation as measured by reductant-dependent ATPase activity; N2O decreased ATP-dependent H2 evolution in an amount approximately equal to the increase in N2 formation; and inhibition by carbon monoxide of N2O reduction eliminated the decrease in ATP-dependent H2 evolution. The inhibition of N2 fixation and N2O fixation by CO suggest that nitrogenase, the site of N2 chemisorption and reduction, not N2O reductase, is the site of N2O reduction. Thus N2O-reducing activity can occur in all organisms and extracts having N2-fixing activity.

6823

APTIC NUMBER 15866

IMPROVEMENTS IN AND RELATING TO THE PREPARATION OF COMPOUNDS OF MORPHOLINE. (Harris-Seybold Potter Co., Cleveland, Ohio) British Pat. 534,936. 3p., March 24, 1941. (Appl. Sept. 19, 1939, 7 claims).

New products or compounds of morpholine having desirable characteristics for use in the fields of photographic developers, local anesthetics, and anti-oxidants are reported. Derivatives of morpholines are prepared by reacting morpholine with sulfur dioxide in the absence of water below 120 C until one-half a mole of sulfur dioxide is absorbed for each mole of morpholine. Water can be added to the reaction product after it is cooled. The derivatives of morpholine, after the addition of water, can be purified by washing with ether or by recrystallization with alcohol.

6824

APTIC NUMBER 16117

Hartkamp, Heinrich
INVESTIGATIONS OF THE STOICHIOMETRY OF THE REACTION BETWEEN GASEOUS NITROGEN DIOXIDE AND THE SALTZMAN REAGENT. (Untersuchungen zur Stoechiometrie der Umsetzung zwischen gasfoermiger Stickstoffdioxid und Saltzman-Reagens). Text in German. Staub, Reinhaltung Luft, 29(11):447-451, Nov. 1969. 9 refs.

From preparative and analytical work and from spectrophotometric investigations, it was determined that the reaction of Saltzman reagent with both nitrogen dioxide and nitrite ions results in the formation of the azo dye, 1-(N-aminoethyl)-amino-4-naphtyl-azobenzene-p-sulfonic acid. This dyestuff, when dissolved in the Saltzman reagent, exhibits a molecular extinction coefficient of 42,150/mole cm at a wavelength of 545 nm. From this constant, the stoichiometric factor governing the reaction between the Saltzman reagent and highly diluted nitrogen dioxide was derived. The stoichiometric factor was 1000 which was in agreement with the findings of Stratman and Buck and in contrast to the value reported by Saltzman. (Author summary modified)

6825

APTIC NUMBER 13415

Haseba, S., T. Shimose, N. Kubo, and T. Kitagawa
NITRIC OXIDE EXPLOSION. Chem. Eng. Progr., 62(4):92-96, April 1966 8 refs.

A method was found to analyze low-concentration hydrocarbons assumed to have contributed to an explosion in the second heat exchanger of a nitrogen wash unit. Acetylene, 1,3-butadiene, and allene existed in the crude gas in the order of 2 to 3 ppm, 0.2 to 0.5 ppm, and 0.2 to 0.3 ppm, respectively. Nitric oxide was detected at concentrations in the order of 0.005 to 1 ppm through oxidation with permanganate and sulfuric acid, followed by calorimetric detection with the Griess-Saltzman reagent. Findings showed that more than 90% of NO entered the unit accumulated in the second heat exchanger, most of it oxidized to nitrogen dioxide and nitrous anhydride, which is more reactive with hydrocarbons than NO. Experiments confirmed the possibility of spontaneous ignition in the second exchanger and the composition of reaction products betwee nitrogen and conjugated dienes. An adsorption process is now used to remove NO, in which Na2Cr02 or Cl2 are added to the wash-water circuit.

6826

APTIC NUMBER 15888

Haselden, G. G.
THE THERMODYNAMICS OF SEPARATION 1. Chem. Tech. (Amsterdam), 74(8):9-16, 1962. 5 refs.

The thermodynamics of the separation of fluid systems are discussed as a means of obtaining a preferable separation sequence and the best exploitation of available driving forces. It is assumed that the gains associated with the thermodynamic approach will be more significant than those associated with the rate process, since the former can lead to new designs for single-stage or cascade units. The latter often only substantiates previous empirical knowledge. Low-temperature gas separation processes are emphasized, but recent developments in this field are generalized and extended to more normal processes. Complimentary ways in which thermodynamics can guide the design of separation equipment are explored by indicating which separation process most nearly approach reversible operation and by showing how the remaining reversibilities (or driving forces) present in any practical process can be used to achieve high process rates. An equation is derived for the minimum power requirements for equimolar mixtures of different numbers of components and for a binary system with different feed compositions. Processes examined are simple separations employing a single-stage phase change without reflux, separation by interchange with a second fluid in single-stage contactors or cascades, and multicomponent separations.

6827

APTIC NUMBER 15138

Haught, Alan F., Russell G. Meyerand, Jr., and David C. Smith
ELECTRICAL BREAKDOWN OF GASES BY OPTICAL FREQUENCY RADIATION. In: Physics of Quantum Electronics. P. L. Kelley and P. E. Tannewald (eds), New York, McGraw-Hill Col, 1966, p. 509-519 9 refs.

The electrical breakdown, i.e., ionization, of gases by high-intensity optical frequency radiation was studied in argon, helium, and neon from 1 atm to 2000 psi and with both ruby and neodymium laser radiation. Studies of the attenuation of the incident laser beam were carried out, and it was established that the energy removed from the optical beam is not scattered at the laser frequency or reradiated by excited atoms but instead is absorbed by the breakdown plasma. The effects of diffusion-like losses on the breakdown threshold were examined by varying the focal volume within which the breakdown is formed. Experimentally, the breakdown threshold is inversely related to the dimensions of the focus volume, indicating that diffusion-like losses are present and play a significant role in the development of optical frequency breakdown. Studies of

the focal volume dependence with neodymium irradiation show that for the larger focal volumes there is a pronounced minimum in the breakdown threshold vs pressure curves. Measurements for a given gas and focal volume were made with both ruby and neodymium radiation to determine the frequency dependence of the breakdown. Neodymium gives a lower breakdown threshold than ruby at low pressures. At high pressures, the neodymium data approach those for ruby as a result of the minimum observed with neodymium. (Author abstract modified)

6828 APTIC NUMBER 14694

Heinrichova, Kveta, Timot Jesko, and Augustin Lukacovic
INFLUENCE OF A MIXTURE OF TRACE ELEMENTS ON SEVERAL VEGETATION PROCESSES OF THE SUGAR BEET. III. CHANGES OF THE NITROGEN-CONTAINING SUBSTANCES. (Einfluss einer Mischung der Mikroelemente auf einige Prozesse im Vegetationsverlauf der Zuckerruebe III. Aenderungen der Stickstoffhaltigen Stoffe). Text in German. Biologia, 21(8):561-571, 1966. 30 refs.

The long-term influence of a selected mixture of trace elements such as B, Mn, Cu, and Zn on the metabolism of nitrogen-containing substances in the leaves, stems, and roots of sugar beets was studied. For this purpose, changes in the total nitrogen content, as well as the nitrogen contained in albumin, ammonia, and amides, was observed. The trace elements were supplied to the plants immediately after propagation via the roots. For determination of the nitrogen content, 20 plants were collected in intervals of 30 to 35 days; the leaves, stems, and tubers were homogenized and analyzed. The influence of the mixture of trace elements became apparent by an increase of the various types of nitrogen-containing substances in the three organs examined. The control plants were richer in soluble nitrogen. Analysis of control plants with symptoms of trace element deficiencies showed an abrupt increase of nitrogen-containing substances, primarily free amino acids and amides, in the leaves. It dropped markedly in the stems and tubers of the control plants as compared to the trace element test plants. This permitted the conclusion that distribution of these substances into stems and tubers is blocked.

6829 APTIC NUMBER 16070

Henriksen, Thermod
EFFECT OF OXYGEN ON RADIATION-INDUCED FREE RADICALS IN PROTEINS. Radiation Res., 32(4):892-904, 1967. 27 refs.

The effect of oxygen and nitric oxide on radiation-induced free radicals in trypsin was studied by electron spin resonance (ESR) spectroscopy. Evacuated samples were irradiated with X-rays at room temperature and kept at this temperature for 20 hrs before ESR measurements were begun. The samples were then opened to an atmosphere of oxygen or nitric oxide, and the reactions between the paramagnetic gases and the protein radicals were followed by qualitative and quantitative ESR observations. The reaction with oxygen resulted in a transient ESR signal consisting of a single line with a (g) value of 2.007 and a width of approximately 13 gauss. The line is presumably due to a peroxide radical. The reaction with nitric oxide results in the direct formation of nonradical products. Experiments with nitric oxide and protein particles of different physical dimensions show that the diffusion theory adequately describes the decay of radicals. It was also found that both sulfur and doublet-type radicals react with paramagetic gases. (Author abstract modified)

6830 APTIC NUMBER 15191

Henry, J. P., Jr., B. S. Cunningham, and C. J. Geankoplis
DIFFUSION OF GASES IN POROUS SOLIDS OVER A THOUSAND-FOLD PRESSURE RANGE. Chem. Eng. Sci., 22(1):11-20, 1967. 21 refs.

Experimental data were obtained for diffusion of gases at constant total pressure in bidispersed porous alumina solids and monodispersed porous Vycor. The data covered a 1300/1 range of pressures which included the Knudsen and most of the transition region. Previous data covered only a 50/1 range. Experimental diffusivities of the alumina compared closely with those predicted by the Pothfeld effectiveness factor model and the Wakao and Smith random pore model. Data on the Vycor also checked the predictions contrary to the findings of others. A possible explanation may be due to the differences in pore structure. Modified equations were derived to extend the random pore model to special cases for diffusion of gases in porous media. (Author abstract modified)

6831 APTIC NUMBER 14856

Herbst, W. A. and N. V. Hakala
STATIONARY APPLICATIONS OF GAS TURBINES AND THEIR FUEL REQUIREMENTS. World Petrol Congr., Proc., 7th, Mexico City, 1967, p. 67-81. 23 refs.

There is growing acceptance of the gas turbine engine in many stationary energy systems. Turbines are used as drives for electric generators, gas compressors, and pumps. Recent developments include adaptation of standard jet turbine engines to intermediate load electric generation and peaking service in electric power production. Heat recovery from turbine exhaust is receiving considerable attention for process use or air conditioning. The fuels used range from gas to residual oils, depending upon economics and availability. Natural gas, naphthas, and aviation jet fuels perform well in most turbines. The suitability of the heavier distillates depends on the turbine combustor design. The ash in some residual oils may cause engine deposit and/or corrosion problems, and special techniques are required to use such fuels successfully. The use of coal in gas turbines is largely experimental at the present time. The most economical fuel depends on the interrelationships among fuel quality, fuel cost, engine type, operating schedule, and maintenance requirements. While some generalizations can be made, additional information is needed for the selection, on a sound quantitative basis, of the optimum fuel for many applications. (Author abstract modified)

6832 APTIC NUMBER 15046

Herkstroeter, William G. and George S. Hammond
MECHANISMS OF PHOTOCHEMICAL REACTIONS IN SOLUTION. XXXIX. STUDY OF ENERGY TRANSFER BY KINETIC SPECTROPHOTOMETRY. J. Am. Chem. Soc., 88(21):4769-4777, Nov. 4, 1966. 26 refs.

Conventional flash techniques were used to measure the acceleration of the decay of various sensitizer triplets in the presence of energy acceptors. An extensive study was made of the stilbenes and 1,2-diphenylpropenes as acceptors. The results are correlated with those obtained earlier in studies of the photosensitized cistrans isomerization of the same substrates. The reactivity in energy transfer remains remarkably high with these substrates even when the triplet excitation energy of the sensitizer is insufficient to produce any known optical transition of the substrates. The result is in good agreement with the hypothesis that flexible molecules can undergo 'non-vertical' transitions to produce twisted geometric forms directly. (Author abstract modified)

6833 APTIC NUMBER 15412

Hertz, H. G. and E. Mann
A STUDY OF THE DEPENDENCE OF THE SEPARATING EFFECT ON COUNTERCURRENT CIRCULATION IN THE GAS CENTRIFUGE. (Zur Abhaengigkeit des Trenneffektes von der Gegenstromzirkulation in der Gaszentrifuge). Text in German. Z. Naturforsch, 10(2):170-1, Jan. 1965. 6 refs.

From a 100 liter storage tank, xenon was passed through a centrifuge so that half of it was left on top and half on the bottom. The isotopic shift of Xe(129) and Xe(136) of the two gas branches was measured. Martin and Kuhn derived the formulas on the basis of one of the two components being admixed with the other in small quantities. This basic assumption was not observed in these experiments. The maximum measured isotopic shift was 1.64. If an inner centrifuge length of 59 cm had been selected instead of 65 cm, the experimental and theoretical isotopic shifts would have agreed, i.e., the effective exchange length would have been just 59 cm. The measured separating effect is illustrated in a diagram. The curves are characterized by the temperature differential between the heaters; the lower heater had a temperature of 13 C and the protective shell outside, 17 C. At low temperature differential (5 C), the separating effect slowly increases to a relatively low value. Upon reaching the optimum temperature differential (10 to 25 C), the maximum separating effect is established rather slowly. With further increase in the temperature differential, the separating effect increases faster, while net result is lower. The empirical optimum separation time was about 100 min; the theoretically obtained time was 96 min. The maximum separating factor was 1.56 + or - 0.03, but was not reproducible in other experiments. This indicates that the separation factor is not only a function of the temperature differential but also of cooling.

6834 APTIC NUMBER 15111

Hess, S. and L. Waldmann
KINETIC THEORY FOR A DILUTE GAS OF PARTICLES WITH SPIN. Z. Naturforsch., 21a(10):1529-1546, 1966. 12 refs.

The relations between the transport coefficients and the various functions of scattering angle and energy which occur in the binary scattering amplitude are derived. The kinetic theory of particles with spin previously developed for a Lorentzian gas is extended to the case of a pure gas. The Boltzmann transport equation for the particle distribution operator is discussed. A magnetic field acting on the magnetic moment of the particles is incorporated throughout. The pertaining linearized collision operator and certain bracket expressions linked with it are considered. The expansion of the distribution operator and of the linearized transport equation with respect to a complete set of composite irreducible tensors built from thy components of particle velocity and spin are discussed. Thus, the distribution operator is replaced by a set of tensors depending only on time and space-coordinates. The physical meaning of these tensors is invoked. They obey a set of coupled first-order differential equations. The reciprocity relations for the relaxation matrices are stated. A detailed discussion of angular momentum conservation is also given. (Author abstract modified)

6835 APTIC NUMBER 16071

Hexter, R. M. and T. D. Goldfarb
INFRA-RED SPECTRA OF QUINOL CLATHRATE COMPOUNDS. J. Inorg. Nucl. Chem., vol. 4:171-178, 1957. 21 refs. (Presented at the Symposium on Molecular Structure and Spectroscopy, Ohio State Univ., Columbus, June 1956.)

Inclusion complexes of Beta-hydroquinone clathrates with hydrogen chloride, hydrogen sulfide, carbon dioxide, and sulfur dioxide molecules were prepared to study restricted and translational modes of the molecules without resorting to low temperatures. Absorption and differential spectra from 1:1-15 micron were obtained by suspending samples in KBr pellets. The obtained spectra, which were investigated with spectrophotometers equipped with NaCL or KBR optics, are in agreement with a proposed difference in crystal structure between alpha-hydroquinone and its Beta allomorph. Spectra of HCl and H2S clathrates indicate that the guest molecules, while present in insufficiently small quantities for detection, profoundly change the quinol crystal structure. Examination of the 700, 800, and 1200 reciprocal cm regions of the SO2 clathrate spectrum demonstrate that the clathrate's crystal structure is that of Beta-hydroquinone. The most significant results were obtained with the CO2 clathrate; they suggest that this clathrate has the crystal structure of an alpha-hydroquinone, or a structure intermediate between the alpha and Beta forms, or that some alpha-hydroquinone is present as another phase. The observed maxima of the CO2 spectrum band are interpreted as wall-collisom-broadened rotational lines of the Q branch of the parallel band of the captured CO2 molecule. The absence of P and R branches suggest that the rotation of th CO2 molecule in its hydroquinone clathrate is not free.

6836 APTIC NUMBER 16454

Heymann, D. and J. Kistemaker
SEPARATION OF SOME ISOTOPES BY CONVECTION-DIFFUSION. Proc. Symp. Isotope Separation, Amsterdam, 1957, chapt. 46:545-550. 2 refs.

The theory of separating gaseous isotope mixtures by convection-diffusion is analyzed and the results of laboratory separation experiments with Ne, A, and H isotopes are discussed. The method is similar to gas separation by sweep diffusion and is based on the elementary effect that occurs when a mixture diffuses into a flowing inert vapor. This effect can be multiplied in porous cylindrical tubes similar to thermal diffusion columns. The columns, which are surrounded by a cold wall, contain a vaporizer and a condensor. Isotopic molecules in the annular space between the vaporizer and condensor are swept toward the cold wall and then diffuse back to the vaporizer. The lighter isoptic molecules are concentrated near the porous tube. The equation for the separatin process assumes that the separation factor is a function of evaporation, pressure, and molecular weight of the sweep vapor. The separation factors, the separating agents and rate of evaporation cu cm/hr, and time of separation in hours for the Ne and A experiments are tabulated. The data show that vertical transport can be small with light gas and heavy vapor. The hydrogen experiments indicate that vertical transport is reversed with hydrogen isotopes. Results from all experiments suggest that the convection-diffusion apparatus is of limited use in preparing small highly enriched isotope samples.

6837 APTIC NUMBER 15817

Kon, Hideo
PARAMAGNETIC RESONANCE STUDY OF NITRIC OXIDE HEMOGLOBIN. J. Biol. Chem., 243(16):4350-4357, Aug. 25, 1968. 36 refs.

The electron paramagnetic resonance absorption of nitric oxide hemoglobin was studied as a possible model system for oxyhemoglobin. The electron paramagnetic resonance spectrum showed three g factors, indicating a rhombic symmetry around the paramagnetic center. When N(15)O was used, the unimpaired electron was found to be hardly associated with NO nitrogen was assumed. Modifying NO-hemoglobin with sodium dodecyl sulfate (SDS) shifted the whole spectrum toward a lower magnetic field retaining the rhombic symmetry. The N(14) hyperfine structure was then resolved in one of the peaks with the splitting of 15 gauss. The number of SDS molecules required to complete this transformation equalled the number of the basic amino acid residues. At SDS concentrations greater than 0.2 M further transformation of the spectrum took place indicating the randomization of the structure and the change of symmetry type around the paramagnetic center from rhombic to axial. NO-hemoglobin powdered specimen after dehydration gave a spectral pattern indistinguishable from that of the SDS-modified NO-hemoglobin. This spectral conversion to dehydrated type was reversed by evacuating and replenishing H2O vapor. Interaction with 0.03 to 0.5 M sodium salicylate decreased absorption, with concomitant appearance of four new peaks presumably due to a low spin Fe(III) type electronic configuration. The possible implication of the rearrangement of the electronic state is discussed in connection with the known oxidase-like activity of oxyhemoglobin under similar conditions. (Author summary modified)

6838 APTIC NUMBER 16491

Higuchi, I.
ABSORPTION VELOCITY OF SULFUR DIOXIDE (SO2) BY SODIUM IODIDE. (Yoka natoriumu no aryusan gasu kyushu sokudo ni tsuite). Text in Japanese. Nikagaku Kenkyusho Ihc (Bull. Inst. Phys. Chem. Res., Tokyo), 15(10:1105-1116, 1936. 5 refs.

Sodium iodide absorbs SO2 gas and produces an orange-colored compound (3NaI-8SO2) and a yellow compound (NaI-4SO2). The dehydrated sodium iodide (NaI) at first absorbs SO2 gas at 0 C producing 2NaI-5SO2 and 3NaI-8SO2; at -21 C, it absorbs an additional amount of SO2 gas producing NaI-4SO2. These compounds are decomposed into NaI and SO2 by reducing the pressure. The NaI obtained here has more rapid and complete absorption efficiency than the merely dehydrated NaI. There is a good correlation between the pressure for decomposition (P) and the absolute temperature (T) with a formula of log P equals 9.8457-2290.1/T. There is another correlation proved between the absorpted SO2 volume (x) and the time used for the absorption with a formula of logS/S-x equals kt to the nth power; where S is the saturated volume of SO2, and the logS/S-x is absorption velocity.

6839 APTIC NUMBER 16592

Hikita, H. and S. Asai
GAS ABSORPTION WITH (M,N)-TH ORDER IRREVERSIBLE CHEMICAL REACTION. Int. Chem. Eng., 4(2):332-340, April 1964. 12 refs. (Also: Kagaku Kogaku (Chem. Eng.), no. 11:823-830, 1963).

Most theories of gas absorption accompanied by chemical reactions deal with zero or first order reactions with respect to a dissolving gas or a first order reaction with respect to a dissolving gas and to a reactant solutes. In the case of gas absorptions accompanied by complex reactions, these theories are useful only for qualitative analysis of the reaction mechanisms. This paper concerns gas absorption accompanied by an m-th order irreversible chemical reaction with respect to a dissolving gas and by an n-th order irreversible chemical reaction with respect to a reactant solute. Based on the film theory and the penetration theory, equations for the gas absorption rate and the reaction rate constants are derived and discussed. Because the proposed equations are applicable to a reaction of any order, both integer and fraction, they can be applied to any reaction system whose reaction velocity is a power function of the concentrations of a dissolving gas and a reactant solute. It is shown that solutions obtained from the equations are in good agreement with analytical solutions or with the available numerical solutions for several systems.

6840

APTIC NUMBER 14560

Hildebrand, Joel H.
SOLUBILITY. XII. REGULAR SOLUTIONS. J. Am. Chem. Soc., 51(1): 66-80, Jan. 1929. 22 refs.

Deviations from Raoult's law and other relations which may be derived from it were studied. It was shown that among substances of low polarity, there exist families of solubility curves which have a marked regularity even where deviations are large. Certain solutions of a common solute in various solvents from which chemical effects and association changes are absent are designated regular solutions. They are defined as solutions in which no change in entropy, except for the small entropy of expansion, is involved in the transfer of a constituent from it to an ideal solution of the same concentration. An equation given by van Laar on the basis of the van der Waals equation of state and recently derived by Heitler upon different assumptions is applied to a large number of solutions with very satisfactory results. The equation is applied to the calculation of other properties dependent upon activity, including the e.m.f. of concentration cells, the heat of solution of solids, the expansion on mixing, and the Gibbs adsorption equation. The numerous solubility data show clearly that the deviations from ideality are rather closely determined by the difference in internal pressure of the two constants, b and k. There is evidence that these are not the only factors and efforts are being made to formulate the exact relation between b and the internal pressure. Meanwhile it is possible to give an improved substitute for Mortimer's table of solubility factors by constructing a table of internal pressure functions that would give values of k by difference.

6841

APTIC NUMBER 16589

Hileman, O. E., J. P. McKinnon, and J. K. Dillard
STATION AND LINE INSULATION DESIGN 1100-KV. Preprint, 10p., 1968. 14 refs. (Presented at the Conference Internationale des Grands Reseaux Electriques, 22nd Paris, June 10-20, 1968, Paper CH 25-06.)

Switching surge and impulse tests were performed to permit design of a 1100-kV station to supply an underground transmission test facility. Using a 1.6 p.u. switching surge design criteria, the support tower for the high-level bus has a 7.45 minimum strike distance with a 9-unit post insulator, 7.5 m in length, hung from the truss. Nine post insulators will be used in the station lower bus. Switching surge test results provided data to assess the design of 1100 kV systems. The comparison of the lightning, contamination, and switching surge requirements showed that it appeared technically unfeasible with present available knowledge and materials to design a 100 kV transmission line to withstand greater than 1.8 p.u. switching surges. Switching surge withstand design levels of 1.6 p.u. are feasible. Although it is technically possible to meet the estimated contamination requirements, the design may be uneconomical in regions of high pollution. Estimates of insulation requirements in 1100 kV stations show that it is technically unfeasible to design switching surge levels greater than 1.6 p.u. using present design philosophy. Contamination may be a greater problem in stations than for transmission lines. Research is immediately required on the breakdown mechanism of large-spaced gaps, methods of reducing the surge applied to a system, and contamination. (Author summary modified)

6842

APTIC NUMBER 15441

Hiser, Remziye Salih
ON THE THERMAL DECOMPOSITION OF ALKALI HALIDES BY THE ACTION OF SODIUM METAPHOSPHATE. (Sur la decomposition thermique des halogenures alcalins sous l'action du metaphosphate de sodium). Text in French. Istanbul Tek. Univ. Bul., vol. 9:1-9, 1956. 3 refs.

Alkali halides heated with sodium metaphosphate at temperatures from 200 to 900 C give the pyrophosphate and liberate the halogen according to the equation: $2NaPO_3 + 2NaX + 1/2\ O_2$ yields $Na_4P_2O_7 + X_2$, where X is a halogen. At high enough temperatures, this is accompanied by the reactions: $2NaX + Na_4P_2O_7 + 1/2\ O_2$ yields $2Na_3PO_4 + X_2$; and $2Na_3PO_4 + Na_2P_2O_6$ yields $2Na_4P_2O_7$. Formation of pyrophosphate is favorable near 700 C. The trisodium orthophosphate was found above 500 C for mixtures containing the bromide or iodide and above 850 C for the other halides. If heated to temperatures below 550 C, the mixture when dissolved in water gave no precipitate of silver halide in the presence of silver nitrate until nitric acid or ferric alum was added. This may be interpreted as showing formation of a compound of the halide with the metaphosphate which is soluble without liberation of halide ions. Decomposition of the bromide and the iodide takes place very slowly in mixtures with metaphosphate, even at 200 C. Below 700 C, the iodide decomposes fastest, but above this temperature, fluoride decomposes fastest. The reaction is catalyzed by steam and probably by silica. The method is applicable to halides of other alkali metals and of the alkaline earths, giving mixed metaphosphates, e.g., $CsNa_2P_2O_7$. Study of mixtures of sodium metaphosphate with sodium salts of volatile oxygen-containing acids showed formation of neutral pyrophosphate and liberation of the corresponding anhydride.

6843

APTIC NUMBER 16078

Hoffman, Kenneth P. and Calvin A. Vanderwerf
ADDITION COMPOUNDS OF SULFUR DIOXIDE WITH PYRIDINE AND THE PICOLINES. J. Am. Chem. Soc., vol. 68:997-1000, June 1946. 29 refs.

Temperature-composition data are presented for systems consisting of sulfur dioxide with pyridine and with alpha-, beta-, or gamma-picoline. Sulfur dioxide and pyridine formed a 1:1 compound, $SO_2$-$C_5H_5N$. The solutions obtained were a light yellow over the entire range of concentrations; red or orange-red solutions were observed only when moisture was admitted to the system or when samples containing an excess of pyridine were heated above 100 deg for several hours in a sealed tube. Addition of appreciable amounts of water to the sulfur dioxide-pyridine system at any concentration led to the immediate formation of a colorless crystalline solid which was stable at room temperature, provided an excess of solution was present. A 1:1 compound was also formed with each of the three isomeric picolines, and similar color and precipitation phenomena were observed. As indicated by the

striking similarity of the sulfur dioxide pyridine and sulfur dioxide-beta-picoline curves, which differ markedly from both the sulfur dioxide-alpha-picoline and sulfur dioxide-gaama-picoline curves, the substitution of a methyl group at the beta position in pyridine meters its basicity to a lesser degree than similar substitutions at the alpha- or beta- positions. Sulfur dioxide also formed a stable 3:2 compound with alpha-picoline and 2:1 compound with gamma-picoline, which undergoes transition at its melting point. The formation of the 2:1 compound is explained by the solvation of the simple 1:1 coordination compound with one mole of sulfur dioxide; the formation of the 3:2 compound by the solvation of the sulfite ion by a single molecule of sulfur dioxide.

6844 APTIC NUMBER 14649

Hoffmann, Karl-Heinz
PROCESS FOR THE EXTRACTION OF ELEMENTARY SULFUR FROM PYRITE. (Verfahren zur Gewinnung von Elementarschwefel aus Pyrit). Text in German. (Metallgesellschaft A. G., Frankfurt am Main, West Germany) W. German Pat. 1,098,921. 4p., Feb. 9, 1961. 3 refs. (Appl. Sept. 27, 1958, 3 claims).

A process is described for simultaneous extraction of elementary sulfur and SO2 from pyrite. In the first stage, the pyrite is roasted in a fluidized bed in the familiar manner, and sulfur is condensed from the gases. In the second stage, the pyrrhotite obtained from the sulfur extraction process is roasted, preferably in a fluidized bed, using excessive quantities of oxygen-containing gases. The SO2 gases which develop are treated in an additional combustion zone where all oxygen in the roasting gases is eliminated by combustion of sulfur. For this purpose, elementary sulfur from the first stage is used (preferably the dirty sulfur accumulating in the pre-condensation stage). The SO2 goes to the first stage as fluidizing gas. The roasting gases, freed from oxygen, are mixed with CO which has been heated to 800 C. The quantity of CO added must be enough to cover the heat demand for the endothermal first stage after reaction with SO2.

6845 APTIC NUMBER 13768

Holder, D. A., A. B. Mindler, and D. F. Manchester
FURTHER EVOLUTION OF AN ION EXCHANGE RECOVERY PROCESS FOR SULPHITE PULPING. Pulp Paper Mag. Can., 66(2):T 55-T 64, Feb. 1965. 15 refs. (Presented at the First International Sulphite Pulping Conference jointly sponsored by the Tech. Sect., Canadian Pulp and Paper Assoc., and the Tech. Assoc. of the Pulp and Paper Industry, Chicago, June 16-18, 1964.)

Extensive pilot-plant investigation showed ion exchange to be a simple way of returning sodium directly from spent liquor to the pulping cycle without involvement in evaporation and burning. An engineering-research-operations team analyzed the technical and economic prospects of the Abipera process of converting spent lignosulfonate into lignosulfonic acid at a specific location, an acid sulfite mill of 100 tons capacity. The process appears to be technically reliable and not subject to erratic performance. Like all processes, its economic prospects are geared to mill capacity and the slight savings indicated at the 100 ton level improve steadily as tonnage increases. Pollution control was not part of the study. (Author abstract modified)

6846 APTIC NUMBER 14450

Hollax, E., K. Schwabe and K. Wiesener
ELECTROCHEMICAL CLEANING OF INDUSTRIAL WASTE GASES AND DEVELOPMENT OF A NEW TWO LAYER ELECTRODE. (Uber die Beseitigung von Industrieabgasen auf elektrochemischem Wege und die Entwicklung einer neuartigen Zweischichtelektrode.) Text in German. Dechema Monograph, 59(1045-1069):147-157, 1968. 14 refs.

Elimination of gaseous pollutants from industrial waste gases poses many problems, particularly the removal of SO2. In an effort to find a satisfactory solution, electrochemical fuel cell experiments were conducted with SO2 diluted with inert gas to obtain a realistic concentration. Results of galvanostatic tests showed that 90% of the SO2 could be removed from the waste gas feed to the anode. Measurement of the potentials against a Hg/hg2SO4 reference electrode in 3.8 n H2SO4 showed that at a fuel dilution of 1:1000 there are theoretical limits with respect to the attainable current density and the cell voltage. Further experiments were concerned with removal of other substances in the waste gas in electrochemical fuel cells. Since oxygen electrodes are 'blubber' electrodes, no difference between pure oxygen and air as reactant was found at the cathode. With methane and carbon monoxide only, considerably lower current densities could be achieved. For conversion of reaction gases, it is advisable to use tightly-sealed, non-gassing electrodes with high electrochemical activity. These demands are fulfilled by a carbon electrode consisting of a hydrophobic substrate and a less hydrophobic coating. The coating layer is produced by surface decomposition of the binding and hydrophobilizing agent of a hydrophobic carbon body in the presence of a catalyst such as Ag, Pt, etc. Its use as an oxygen electrode is discussed. The effects of operating parameters such as temperature, gas pressure, oxygen partial pressure and KOH concentration on electrochemical power generation and on long-term performance are discussed.

6847 APTIC NUMBER 15848

Hooker, George W., Lewis B. Drake, and Stephen C. Stowe
REACTION OF SULPHUR DIOXIDE WITH DIOLEFINS AND SEPARATION OF LATTER FROM HYDROCARBON MIXTURES. (Dow Chemical Co., Midland, Mich.) U. S. Pat. 2,395,050. 7p., Feb. 19, 1946. (Appl. May 14, 1940, 12 claims).

A method for reacting sulfur dioxide with conjugated diolefins to produce crystalline sulfones that are readily decomposed by heat specifically concerns the separation of butadiene-1.3 from mixtures with a butylene or butane. The sulfur dioxide and diolefin material, which should contain at least 0.75 part by weight of sulfur dioxide per part of hydrocarbon, is charged in an autoclave or bomb under pressures sufficient to cause partial liquefication. In its early stages, the reaction takes place

between 100-150 C; these temperatures are lowered to about 70 C during the reaction. Heating is continued until the reaction approaches equilibrium between the sulfone product and the sulfur dioxide and diolefin reactants. At 70 C, almost complete conversion of butadiene to the sulfone is achieved. Although the reaction produces an adequate yield of crystalline sulphones without the use of inhibitors, polyhydric phenols can be added to prevent formation of amorphous sulphones. These inhibitors also counteract the tendency of diolefins to undergo partial polymerization at high temperatures. Only a few hours are required to produce the crystalline sulfones. Hydrocarbons are vaporized from the sulfones releasing the pressure and sulfur dioxide by mild heating. The sulfone can be dissociated into the diolefin and sulfur dioxide by more vigorous heating at 120 C or above.

6848

APTIC NUMBER 15842

Horii, Taro
NICKEL MAT MANUFACTURE BY THE USE OF SULFUR DIOXIDE WASTE GAS. (Hai-Aryusan gasu o riyosaite nikkeru-matto o seizo suru hoho). Text in Japanese. (Assignee not given.) Japanese Pat. Sho31-7254. 2p., Aug. 24, 1956. (Appl. Oct. 27, 1954, claims not given).

This patented method prescribes that sulfur dioxide gas produced in the second step of nickel manufacturing (purification) be utilized in the first step for the manufacture of a nickel mat which includes 25 to 45% nickel, 40 to 60% iron and 6 to 20% sulfur. Nickel-containing mineral (650 kg) is burned using 200 kg of coke and 1000 cu m of air including 10 kg of SO2 waste gas for 50 min. The nickel mat obtained by this procedure contains 32.5% nickel, 9.6% sulfur, and 55.8% iron, as compared with 27.5% nickel, 10.2% sulfur, and 60.4% iron, obtained by using a plaster (35 kg) and a larger amount of coke (220 kg). Without using iron sulfide and plaster, or using a small amount of these materials, the nickel mat is manufactured by the use of SO2 waste gas from the refinery hearth. In addition, the coke fuel can be saved, since the SO2 waste gas has a high temperature (150 to 200 C). The use of the SO2 waste gas also decreases air pollution around the factory.

6849

APTIC NUMBER 15298

Horvath, Zoltan
INVESTIGATION OF THE THERMODYNAMICS OF ROASTING OF SPHALERITE AND PYRITE. (A szfalerit es pirit oxidalo perkolesenel lejatszodo reakciok termodinamikai vizsgalata). Text in Hungarian. Kohasz. Lapok, no. 4:163-176, 1955.

Theoretically deduced equations that show the oxidation products of ZnS and FeS under different conditions of temperature and partial pressure are presented. The calculations are based on the normal thermodynamic potential values obtained from the literature. In the case of ZnS, the influence of the most important catalyst, Fe2O3, is considered and was found to be very small below 640 C; at this temperature, approximately half of the SO2 will be oxidized. Above 770 C, all the zinc sulfates undergo thermal decomposition. Intensive decomposition of pyrite starts at 900 C. The subsequently developing iron and sulfur oxides may be the result of any of five possible reactions. The composition of the ensuing gas phases is presented on the basis of their normal potentials. The influence of the reaction surface and grain size on the oxidation rate is also discussed. Reaction velocity is proportional to the reciprocal of the grain size.

6850

APTIC NUMBER 16396

Hsiung, Chi-hua and Adon A. Gordus
MOMENTUM TRANSFER TO AN ATOM IN A MOLECULE: INTERNAL EXCITATION AND BOND DISSOCIATION. J. Chem. Phys., 36(4):947-953, Feb. 15, 1962. 5 refs. (Presented in part at the 140th Meeting of the American Chemical Society, Chicago, Sept. 3-8, 1961.)

An equation was derived relating recoil momentum to the bond energy, bond angles and distances, and the masses of the atoms in the molecule. It was assumed that the rotational and vibrational motions of the molecule are independent and can therefore be separated, and that the momentum impulse is acquired by the atom in a time period which is short compared to the time required for the dissociation of the atom. This dissociation time is probably of the order of ten to the minus 14th power sec, the time required for one vibration. This is the most critical assumption, leading to the approximation that atoms other than the recoiling atom do not experience an increase in space velocity. It is not obvious how to correct for this effect, since the time sequence of momentum transfer through the molecule is not known. Since some intramolecular momentum transfer undoubtedly does occur, calculated values of the recoil momentum were low. The extent of correction would probably depend on the complexity of the molecule. Thus, for recoiling bromide, the recoil momentum for methyl bromide would be closer to the correct value than would the recoil momentum for ethyl bromide. (Author summary modified)

6851

APTIC NUMBER 14878

Hughes, A. E. and F. K. Cameron
ACTION OF SULFUR DIOXIDE ON PHOSPHATES OF CALCIUM. J. Ind. Eng. Chem., 23(11):1262-1271, Nov. 1931. 38 refs.

The effect of sulfur dioxide, alone and in the presence of water, on the more basic calcium phosphates over a range of temperature and pressure which might be commercially practicable was studied. Vapor pressures were determined for the systems SO2-water and SO2-water-Ca3(PO4)2, between 0 and 90 C. The results of previous investigators were confirmed, but the range of observations was extended. Tricalcium phosphate and phosphate rock, when treated with saturated aqueous solution of sulfur dioxide, at 25 to 100 C and pressures from 3 to 10 atm are completely dissolved. The phosphoric acid (P2O2) goes into solution more rapidly; if, however, on the establishment of equilibrium, the liquid phase is so small that a solid phase persists, then calcium oxide is present in excess of the phosphoric acid in the solid phase. All the phosphoric acid is made available by such treatment. Direct measurements

of the volume of sulfur dioxide absorbed by tricalcium phosphate were made over a wide range of temperatures and at several pressures. This method of dry treatment was applied to phosphate rock up to 1100 C. The reactions involved are very complex, and much sulfur dioxide is decomposed. The maximum phosphoric acid rendered available is about two-thirds of the total present. No procedure utilizing sulfur dioxide for the production of fertilizers promises, under present conditions, better economy than the standard methods of treating phosphates with sulfuric acid. (Author abstract modified)

6852 APTIC NUMBER 14506

Hull, William Q., Frank Schon, and Hans Zirngibl
SULFURIC ACID FROM ANHYDRITE. Mod. Chem. Processes, vol. 5: 123-133, 1958. 12 refs. (Also: Ind. Eng. Chem., Aug. 1957.)

The chemistry of sulfate decomposition and differences in cement clinker production are discussed. The effect of decomposition speed, dependence on temperature and additives, particle size, and granular size with gypsum residues from the sulfate decomposition were investigated. In the industrial anhydrite sulfuric acid process, coke is used as a reducing agent and enough aluminum-containing materials are added so that portland cement is produced per ton of acid. Dissociation of the calcium sulfate consists of three stages; $CaSO_4$ plus 2 C yields CaS plus $2CO_2$; CaS plus $3CaSO_4$ yields $4CaO$ plus $4SO_2$ (the overall reduction process is $2CaSO_4$ plus C yields $2CaO$ plus $CO_2$ plus $2SO_2$); and $3CaS$ plus $CaSO_4$ yields $3CaO$ plus $2S_2$. The CaS and $CaSO_4$ have, at each temperature, a definite decomposition pressure. Additives of clay or similar materials raise the decomposition pressure and the temperature in order to maintain the same decomposition rate. Too much CaS and $CaSO_4$ also lowers the decomposition rate. As far as sulfur dioxide is concerned, this is the end of the process. The rest involves making the cement clinker. A further rise in temperature up to 1400 C completes the reaction between the components and lime, formed during decomposition, to produce a good clinker. Besides an exact adjustment of the proportions of the reduction coke to the anhydrite, the proportions of the added materials to the CaO and to each other must be carefully adjusted within determined limits so that a good clinker results. Even more important, kiln operation must be carried out under steady conditions. Heat consumption for clinker in the anhydrite sulfuric acid process as compared with that of normal portland cement clinker must also be considered. A typical plant and its contact process are described. Production is inexpensive, and cement is sold at market value. There was no difficulty in marketing surplus acid.

6853 APTIC NUMBER 15130

Hurley, F. I.
ISOTOPE SEPARATION. Engineering (London), 187(4849):202-205, Feb. 13, 1959. 28 refs.

The state of the art of diffusion, nozzle, and centrifuge methods for the separation of uranium isotopes is reviewed, followed by a discussion of the separation of light element isotopes of interest in atomic energy, with emphasis on the production of heavy water by deuterium separation or hydrogen distillation. The use of centrifuges may eventually prove to be the most economical method available to West European plants for separating uranium isotopes, but their development, like that of nozzles, is still in the research state. High capital costs and the properties of the separating membrane are dominant factors in the design of a diffusion plant; membranes with small pores are required, and pore dimensions can be estimated only by indirect measurements. Moreover, flow through fine holes deviates from the recognized laws of kinetic flow. Light isotopes are used in fundamental investigations in physics and nuclear physics, in biological and chemical investigations, and for tracers. In general, only small quantities of the separated isotopes are needed. Economic considerations need not limit the choice of methods for separating such isotopes are oxygen 17 and boron 10; it is only in the case of the separation of hydrogen and deuterium that large-scale plants are required and economic factors predominate. Operating costs contribute about $14 per pound to the price of $28 per pound for the heavy water produced at the United States' Savannah River plant. Two new European processes for deuterium separation are described.

6854 APTIC NUMBER 14561

Iler, Ralph K.
PROCESS OF MANUFACTURING ALKALI AND AMMONIUM CHLOROSULPHONATES. (Du Pont de Nemours and Co., Wilmington, Del.) U. S. Pat. 2,219,103. 2p., Oct. 22, 1940. (Appl. Oct. 22, 1937, 3 claims).

A process is described which particularly relates to the manufacture of sodium chlorosulfonate. A homogeneous sodium chlorosulfonate may be prepared by contacting sodium chloride with sulfur trioxide and subjecting it to attrition. Attrition may be effected by the use of a ball mill, an edge roller mill, or other suitable equipment at a temperature between 50 and 60 C. The reaction of sulfur trioxide with chlorides is exothermic, and the temperature may be controlled by the rate of gas flow. Suitable heating or cooling devices may be used as required. The sulfur trioxide content of the final product may be adjusted to a desired figure by discontinuing the operation when a desired composition is reached. It is important that moisture or water in any form be kept out of contact with the reactants and the products, otherwise the product will be decomposed in proportion to the amount of water present. This process is applicable to the manufacture of sodium, potassium, and ammonium chlorosulfonates.

6855 APTIC NUMBER 15801

Ingles, D. L.
SOME NOVEL ADDUCTS OF SULPHUR DIOXIDE WITH CARBONYLS AND AMINO-ACIDS. Chem. Ind. (London), no. 35:1492-1493, Sept. 2, 1967. 7 refs.

Three bisulfite adducts of the Schiff base formed by the interaction of a carbonyl compound and an amino acid are reported. The adducts were obtained by bubbling sulfur dioxide through a suspension of glycine and glyoxal in water, glycine

and formaldehyde, and glycine and diacetyl. All adducts show similar properties: each is a strong acid, gives no precipitate with barium chloride, and contains only bound sulfite. None reacts with iodine. In alkaline solutions, the adducts undergo hydrolysis to release the carbonyl compound, glycine, and the sulfite ion. A betaine-type structure involving amino and sulfonic acid groups is proposed for the adducts. It is concluded that these bisulfite adducts play a part in the preservative action of sulfur dioxide in foods.

6856 APTIC NUMBER 14745

Ingraham, T. R.
THERMODYNAMICS OF THE THERMAL DECOMPOSITION OF CUPRIC SULFATE AND CUPRIC OXYSULFATE. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), 233(2):359-363, Feb. 1965. 20 refs.

The thermal decomposition of cupric sulfate and cupric oxysulfate was examined by determining the equilibrium gas pressure generated over each pure compound. The equilibrium data were used to calculate the thermodynamic properties of both compounds. The results were combined with previously published data to establish a predominance-volume diagram for the Cu-S-O system over a normal range of roasting temperatures and gas compositions used in the treatment of copper minerals. It was found that copper oxysulfate recrystallizes at 1100 K with an apparently irreversible endothermic heat requirement of approximately 2.9 kcal per mole. (Author abstract modified)

6857 APTIC NUMBER 16210

Institute of Gas Technology, Chicago, Ill.
LNG: A SULFUR-FREE FUEL FOR POWER GENERATION. Contract PH 22-68-58, Final Report, Proj. 8926, 560p., May 1969. 450 refs. CFSTI PB 184353

The availability of natural gas for conversion to liquified natural gas (LNG) and subsequent transport to the U.S. East or West Coast was assessed. Transport costs to the point of use and the cost of electric power with LNG used as power plant fuel were estimated. Price and availability of gas at a remote source was based on current information about reserves, indigenous requirements, and marketing plans of the agencies controlling gas at the source. Combustion of natural gas is easily controlled, and the fuel is easily metered and handled, an important factor in keeping plant costs low. When compared to the cost of electricity generated by competitive fuels, LNG could possibly be a lower cost fuel. Natural gas use and availability are discussed for the U.S. and the world. The long-term viability of the U.S. natural-gas producing industry depends on the quantity of natural gas reserves ultimately available. The remaining recoverable reserves were estimated to be 976-1645 trillion CF of gas. Areas of the world which, because of their reserves, availability of gas for export, and proximity to the U.S., are potential sources of imported gas are Algeria, Libya, Nigeria, Venezuela, Colombia, Trinidad, Alaska, and Canada. The economic feasibility of LNG for electric power production is demonstrated: natural gas is the most economical fuel available for electric power production. The feasibility of using LNG as a sulfur-free fuel for power generation will depend on delivery costs, which varied considerably with the alternatives evaluated. Noneconomic factors affecting the feasibility of LNG for electric power production are also discussed. Regulatory and political factors are considered.

6858 APTIC NUMBER 14384

Ioshpa, I. Ye.
KINETICS OF NITROGEN DIOXIDE ABSORPTION BY A SULFUR-NITROGEN MIXTURE. (Kinetika protsessa absorbtsii dvuokisi azota serno-azotnoy smes'yu). Text in Russian. Dokl. Vses. Nauch. Konf. Rab. Kafedr Tekhnol. Neorg. Veshchestv, Nauch. Uchrezhd. Proekt. Organ., 4th, Tashkent, 1964, p. 74-81.

If a sulfur-nitrogen mixture is saturated with a gas containing 32% NO2 at 30 C, it is possible to obtain a solution containing 14-15% N2O3 and 10-11% HNO3. It was found experimentally that at 30C, the absorption rate coefficient can be raised from 1.32 to 7.75 g/sq m-hr-mm Hg by irrigating the column packing with a solution of the following composition: 7.78% N2O3, 0.3788% HNO3, 87.24% H2SO4, and 4.57% H2O. An experimental curve was plotted which allows determination of the height of the packing and the mass-exchange surface area needed to achieve NO2 removal to near equilibrium concentration. Curves are also given for determining the required packing surface area for saturation of a sulfur-nitrogen solution with NO2 to the appropriate concentration with respect to N2O3 and HNO3. The coefficient of absorption rate as a function of packing height was plotted and can be used to differentially calculate the required packing surface area under industrial conditions in series-connected towers. A correction factor is derived which relates the coefficient of absorption rate for the ring-shaped test packing to that of 25 times 25 times 3 mm industrial packing. This was done by examining the kinetics of absorption of ammonia by water on the same installation under the same hydrodynamic regime.

6859 APTIC NUMBER 16679

Isbell, R. E., E. W. Wilson, Jr., and D. F. Smith
CRYOSCOPIC BEHAVIOR OF SELECTED SOLUTES IN THE MOLTEN ALKALI NITRATES. I. MOLTEN LITHIUM NITRATE. J. Phys. Chem., 70(8): 2493-2499, Aug. 1966. 13 refs.

Freezing point measurements were taken on dilute solutions of LiF, KNO3, NaNO3, Na2SO4, Li2SO4, KCl, CaSO4, NaCl, and LiCl in molten lithium nitrate as a solvent. Many of these solutions exhibit ideal behavior, as evidenced by the excellent agreement of the experimentally obtained freezing point constant for lithium nitrate with that obtained using the reported heat of fusion for lithium nitrate. Thermodynamic stability constants were determined in lithium nitrate and lithium nitrate-sodium sulfate or sodium chloride mixtures for CdSO4, PbSO4, CuSO4, CoCl2, CoSO4, and CdF2. The copper sulfate-lithium nitrate and cadmium sulfate-lithium nitrate systems may contain complexes of the type Cu(SO4)2(2-) and Cd(SO4)2(2-). The cadmium fluoride-

lithium nitrate system did not appear to have any complexes formed in the concentration range 0.0-0.14 m. (Author abstract modified)

6860 APTIC NUMBER 15821

Ishkin, I. P. and Ye. S. Dubil'
KINETICS OF THERMAL DISSOCIATION OF SODIUM AND POTASSIUM BICARBONATES. (Kinetika termicheskogo razlozheniya bikarbonatov natriya i kaliya). Text in Russian. Zh. Prikl. Khim., 41(1):52-58, 1968. 23 refs.

The possibility of using a pseudofluidized layer of particles to study the rate of a topochemical process was demonstrated for the thermal dissociation of sodium and potassium bicarbonates. The process of dissociation of bicarbonates, which are limited by the transfer of heat, proceed in the thermal region and are satisfactorily described by the theoretical kinetic equations of Yerofeyev and Roginskiy. Calculated values for the energy of activation are 40.1 kcal/2 moles for sodium bicarbonate and 39.6 kcal/2 moles for potassium bicarbonate. These values, compared with values for the thermal effects of the dissociation (-30.85 kcal/2 moles and -32.82 kcal/2 moles, respectively), indicate the presence of the same dissociation mechanism for both salts.

6861 APTIC NUMBER 13738

Islam, Muneerul and M. A. Nawab
ADSORPTION OF SULPHUR DIOXIDE ON BARIUM CHROMATE. Pakistan J. Sci. Res., 18(2/3):142-150, 1966. 7 refs.

Adsorption of SO2 on BaCrO4 was studied from 100 to 400 C over a range of equilibrium pressures, and the volume of the adsorbed gas was plotted against the corresponding equilibrium pressure. The curves obtained show that the higher the equilibrium pressure, the higher the values of the adsorbed gas. The volume of gas adsorbed also increased with a rise in temperature. The apparent obedience of some experimental data to Longmuir isotherms and B. E. T. theory is analyzed, and the nature of adsorption is discussed. Calculated values of heats of adsorption were unusually low compared to other values for chemisorption. They are attributed to a very weak bond between the chromate and SO2. Positive temperature coefficients indicate the absence of physical adsorption. In one experiment where the temperature was about 425 C and the pressure of the system was above 40 cm, Hg. Sulfur dioxide was found to react chemically with the chromate. (Author abstract modified)

6862 APTIC NUMBER 16293

Jackson, J. K., M. S. Bonura, and D. F. Putnam
EVALUATION OF A CLOSED-CYCLE LIFE-SUPPORT SYSTEM DURING A 60-DAY MANNED TEST. Preprint, Society of Automotive Engineers, Inc., New York, 19p., 1968. 9 refs. (Presented at the Aeronautic and Space Engineering and Manufacturing Meeting, Los Angeles, Calif., Oct. 7-11, 1968. Paper 680741.)

A 60-day manned test of an advanced regenerative life-support system was completed in a space cabin simulator. The test was designed primarily to evaluate systems for recovering potable water from urine and humidity condensate, and oxygen from carbon dioxide. Other life-support equipment included a thermal control subsystem, a two-gas atmosphere control, a trace contaminant removal system, and a fecal waste collector featuring vacuum dehydration. The oxygen recovery system used the Sabatier reactor process, which involves the hydrogenation of CO2 to yield water and methane. The methane and noncondensible gases were dumped overboard, and the condensed water was periodically pumped to a unit where the water was electrolyzed to recover O2. Trace contaminants were controlled by a catalytic oxidizer (toxin burner), a charcoal adsorbent bed in an open-loop evaporator system, and a chemisorbent/charcoal bed in the toxin control unit. Forty-seven different failures of equipment were noted, but standby procedures and equipment maintained acceptable conditions until repairs could be made. These failures are unlikely to occur on fully developed equipment. Introduction of the open-loop evaporation system caused an increase in ammonia concentration in the cabin, with a possible secondary production of nitrogen oxides. The trace system was effective in preventing these and other toxic compounds from reaching alarming levels.

6863 APTIC NUMBER 15783

Jasper, Joseph J. and J. Russel Bright
MOLECULAR SURFACE ENERGY OF SULFUR DIOXIDE ADDITION COMPOUNDS. J. Am. Chem. Soc., vol. 66:105-106, Jan. 1944. 6 refs.

The effect of temperature on molecular surface energy of equimolar mixtures of tripropylamine and tributylamine with SO2 was determined. Data are presented for the density, surface tension, and viscosity from 17-45 deg for tripropylamine and 1-40 deg for tributylamine. Eotvos constants were calculated and found to be less than those of the lower molecular weight addition compounds of tertiary aliphatic amines with SO2. The temperature coefficient of the molecular surface energy seems to decrease with increasing molecular weights of the addition compounds, and the tendency to associate decreases. Parchor data furnish additional evidence for the existence of a nitrogen to oxygen to sulfur (N-O-S) linkage in this type of compound. (Author summary modified)

6864 APTIC NUMBER 16610

Jiru, Pavel and Vladimir Jara
A STUDY OF THE INFLUENCE OF ALKALI METAL SULFATES ON THE ACTIVITY OF VANADIUM PENTOXIDE IN THE CATALYTIC OXIDATION OF SULFUR DIOXIDE. (Beitrag zum Studium des Einflusses von Alkalimetallsulfaten auf die Aktivitaet des Vanadiumpentoxyds bei der katalytischen Oxydation des Schwefeldioxyds). Text in German. Actes Congr. Intern. Catalyse, 2nd, Paris, 1960, vol. 2:2113-2119, 1960. 7 refs.

The X-ray structure, infrared spectra, and catalytic activity of rubidium or cesium sulfate melts with vanadium pentoxide of various composition were studied. In melts with equimolecular ratios of both components, a new compound of the type Me2SO4V2O5 (Me equals Rb or Cs) is most likely to develop. The catalytic activity of a catalyst obtained from the mentioned compounds of Rb or Cs is nine times higher in oxidizing SO2 than that of a catalyst prepared from K2SO4V2O5. For comparison, the results of activity studies on catalysts obtained from equimolecular melts of lithium or sodium sulfate with vanadium pentoxide are given. The high activity of the studied model catalysts is explained by Myer's hypothesis, according to which a substance becomes a catalyst if it is bound to one of the reacting molecules by a bond whose vibration frequency is close to that of the second bond of the reacting molecule.

6865 APTIC NUMBER 16608

John, G. S., M. J. Den Herder, R. J. Nikovsky, and R. F. Waters
PHYSICOCHEMICAL STUDIES OF MOLYBDENA RE-FORMING CATALYSTS. In: Advances in Catalysis. Adalbert Farkas (ed.), vol. 9, New York, Academic Press, 1957, Chapt. 27, p. 252-267. 22 refs.

In reforming a virgin naptha over molybdena on alumina, best performance is attained with a cogelled catalyst containing about 10% molybdena. To understand the fundamental aspects of this performance, several physicochemical properties of cogelled catalysts were investigated. Hydrogen-deuterium studies, in addition to showing a minimum in exchange ability, reaffirmed that the effectiveness of the molybdena depends on the method of catalyst preparation. Estimates based on naptha conversion indicate that only 70-75% of the molybdena is dispersed on the external surface of the catalyst. A stable nonstoichiometric molybdous oxide is postulated as the catalytically active component. Abrupt, reproducible discontinuities in the kinetic constants of nitrous oxide from decomposition studies are interpreted as indicative of either electronic or structural changes in the active component of the catalyst. The stabilizing influence of alumina was evidence of a delicate balance of bonding forces and was seen in the conductive properties and heats of solution near 10 wt% MoO3. The studies also revealed that water has a stabilizing effect upon the nonstoichiometric oxide. Thermodynamic information shows that MoO3 is the stable phase in water vapor, while molybdenum is the stable phase in the presence of hydrogen. The variance of experimental observation from the thermodynamic calculations is attributed to an interaction between the alumina and molybdena and the stabilizing influence of water. In commercial reforming, the chemistry of the catalyst is further complicated by the presence of sulfur compounds. Sulfur dioxide absorption studies show that dispersing a monolayer of molybdena over the alumina surface will prevent adsorption of SO2. It is concluded that in the preparation and use of reforming catalysts, attention should be centered on the conditions which produce and stabilize the active intermediate oxide. Best performance is attained with a catalyst combining a high surface area with a high degree of dispersion and availability of the molybdena. These factors must be balanced against operational conditions that influence the degree of reduction of the molybdena and the accumulation of sulfur.

6866 APTIC NUMBER 15746

Jones, I. T. N. and R. P. Wayne
PHOTOLYSIS OF OZONE BY 254-, 313-, AND 334-NM RADIATION. J. Chem. Phys., 51(8):3617-3618, Oct. 15, 1969. 7 refs.

Evidence is presented which suggests that excited singlet O2 is formed at wavelengths longer than 310 nm. Quantum yield measurements for ozone photolysis gave indirect evidence for the production of O(D 1) and the singlet O2 at 254 nm. At 313 nm, singlet O2 is still produced, but most of the oxygen atoms are O(P 3); at 334 nm, the primary products are exclusively O(P 3) and singlet O2. The primary steps at 313 and 334 nm therefore appear not to give spin-conserved products, suggesting that spin-conservation rules may not apply when absorption is weak.

6867 APTIC NUMBER 15860

Kalman, Nicholas L.
TREATMENT OF ABIETYL COMPOUNDS. (Hidbo Labs., Inc., Paterson, N. J.) U.S. Pat. 2,395,278. 14p., Feb. 19, 1946. (Appl. July 3, 1943, 7 claims).

An inexpensive process is described for treating abietyl compounds to produce rosin acids, rosin esters, rosin alcohols and other materials of high stability. The material to be treated may have one or two double bonds. The treatment involves heating the abietyl compound to be stabilized and bringing SO2 gas into intimate contact with the heated compound, preferably by bubbling the gas through the material being treated. For most purposes, temperatures should be about 170 C, e.g., below the point at which appreciable decarboxyation occurs. However, temperature up to 230 and 250 can be used. Stability of the treated products is thought to be due to an extensive reduction in saturation and to partial aromatization. A compound can also be treated with an esterifying or saponifying agent prior to bubbling SO2 through the mixture. Treated compounds can be further processed by distillation, and the constituents of the material can be separated by solvent extraction, fractional precipitation, crystallization, sulfonation, etc. The treated compounds can be employed in a large scale in paper making, soap manufacturing, in coating compositions, in printing inks, and in the paint and varnish industry.

6868 APTIC NUMBER 16463

Kashtanov, L. I. and V. P. Ryzhov
INVESTIGATION OF THE OXIDATION KINETICS OF GASEOUS SULFUR DIOXIDE IN WATER SOLUTIONS AND THE PROCESSES OF CONTAMINATION OF MANGANESE SULFATE WITH PHENOL. (Izucheniye kinetiki okisleniya gazoobraznogo sernistogo angidrida v vodnykh rastvorakh i protsessov otravleniya sernokislogo margantsa fenolom). Text in Russian. Izv. Teplotekhn. Inst., 1939:37-40. 7 refs.

Oxidation of SO2 in water solutions was studied experimentally to determine the effect of phenol both with and without MnSO4 catalyst. The following conclusions were reached. Oxidation processes taking place during absorption of SO2 by a solution are analogous to those for oxidation of solutions of sulfuric acid. The percent of oxidation decreases as the total quantity of gas passing through the adsorbing liquid is increased. The percent of desorption increases as the total gas flow rate through the absorber increases. The percent desorption increases as SO2 concentration of the solution increases. Manganese sulfate salts increase oxidation rate twofold. The presence of phenol in the solution retards autooxidation of SO2, the percent oxidation decreasing with increased phenol concentration. Phenol in amounts of 0.1% completely eliminates catalytic action. Trace amounts of phenol sharply decrease the rate of autooxidation both with and without catalyst. Increasing the phenol concentration above 0.1% has practically no further effect. Oxidation of SO2 takes place not only in solution, but also at the surface of the solvent.

6869 APTIC NUMBER 14807

Kazanskiy, A. B.
RICHARDSON CRITICAL NUMBER. (O kriticheskom chisle Richardsona). Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana, 1(6):876-879, 1965. 11 refs. Translated from Russian. Foreign Technology Div., Wright Patterson AFB, Ohio, Translation Div. FTD-HT-23-1053-67, 7p., Jan. 26, 1968.
CFSTI: AD 678615

The Richardson number (Ri) was studied in the range 0-Ri (critical), in a stably stratified surface boundary layer of the atmosphere. Expressions were derived for evaluating the magnitude of the interval 0 less than Ri less than Ri (critical), and for estimating the value of Ri (critical). The accuracy of the approximation formula was confirmed for a significant portion of the range studied.

6870 APTIC NUMBER 14361

Keffer, J. F.
RESEARCH IN STRATIFIED FLOWS. Toronto Univ., Canada, Dept. of Mechanical Engineering, TP 6605, 29p., Sept. 1966. 13 refs.

The design, construction, and performance of a small low-speed wind tunnel which has provision for producing a temperature-stratified flow are described. The proper evaluation of the thermal transport quantities requires some effort and is particularly difficult in a shear flow such as a wake. A number of investigations underway relate mainly to the manner in which an inert contaminant is diffused by a particular turbulent flow. Advantage was taken of the turbulence field produced by the heating rods. A step change in temperature profile produced at the heating rods was allowed to diffuse with the result that a mixing zone formed and grew with the distance downstream. Using classical methods of mixing-length theory, it is possible to predict the growth rate. In addition, by measuring the turbulent transport terms and assessing the magnitude of the turbulent energy and its distribution, a more precise picture of the small-scale structure of the flow may be obtained. As an extension of that study, a velocity discontinuity was superimposed upon the step change in temperature. A fine mesh screen which blocks half the flow in the tunnel was placed upstream of the heating rods. This generates a shear field in the region of the temperature discontinuity and the interaction of the two fields which occurs is being studied. A different approach makes use of the turbulent field produced by a two-dimensional cylinder placed a considerable distance downstream from the heating elements where the background turbulence level is low. The wake from the cylinder generates a shear field which strains the mean flow symmetrically. Superimposed upon this flow is a linear temperature profile which is unsymmetrical with respect to the wake. A production of the growth of the mean thermal wake appears possible from a self-preservation analysis of the equations, and measurements of temperature fluctuations and transport terms are in progress. A further study was completed on the effect of varying screen shapes on mean velocity and temperature distributions. An analytical method was developed for the prediction of screen geometry necessary to produce specific profiles and the results agreed well with experiment. (Author summary modified)

6871 APTIC NUMBER 14752

Kharmandaryan, M. O. and Ye. L. Kopelevich
EFFECT OF TOTAL PORE VOLUME ON SULFUR DIOXIDE ABSORPTION IN SILICA GELS. (Vliyaniye obshchego ob'yema por v silikagelyakh n. adsorbtsiyu sernistogo gaza). Text in Russian. Zh. Fiz. Khim., 8(2):300-305, 1936. 6 refs.

The effects of means of coagulation and washing of silica gels, metallic activators, concentration of starting solutions, and acid dose on pore volume and SO2 absorption were studied. It was found that absorption depends not upon total pore volume but rather on the differential distribution of pore radius. An optimum radius of 0.765 times 10 to the minus 7th power cm was established, acid gels having a maximum percentage of cells with this radius. An extremely characteristic index for determining gel activity is gravimetric weight. Application of more concentrated solutions of water glass does not reduce gel activity with a corresponding increase in acid concentration. When the gel is precipitated with metal salts, maximum activity is exhibited by silica gels with iron.

6872 APTIC NUMBER 14639

Khvorostukhina, N. A., Yu. V. Rumyantsev, and I. K. Skobeev
REACTION OF METALLIC INDIUM WITH SULFUR DIOXIDE. (Vzaimodeystviye mezhdu metallicheskim indiyem i sernistym gazom). Text in Russian. Fiz.-Khim. Analiz, Akad., Nauk SSSR, Sibirsk. Otd., Inst. Neorgan. Khim., Tr. Yubileinoi Konf., Novosibirsk, 1960, 1963:63-70. 9 refs.

It was established experimentally that metallic indium begins to react with sulfur dioxide at 635 C and at a pressure of 300 mm Hg. Reaction proceeds with the formation of indium oxide and indium sulfide over the range 635-975 C. Above 1000 C, reaction is in the opposite direction, yielding the metal and

sulfur dioxide. In the range 635-750 C, sulfates are also formed, but these decompose at 800 C and higher. The formation of oxide and sulfide takes place in the kinetic region at 635-800 C but shifts to the diffusion region at higher temperatures. Reaction between indium sulfide and indium oxide sets in at 800 C, when sulfur dioxide is removed. The separating metallic phase sublimates and upon cooling reacts with sulfur dioxide to form sublimates of secondary oxide and sulfide. Above 1000 C, sublimation of the sulfide and dissociation of the oxide take place, but these processes are of secondary significance.

6873 APTIC NUMBER 13525

Kilburn, Kaye H.
CLEARANCE FROM ALVEOLI TO THE CILIARY ESCALATOR: IMPLICATIONS FOR PULMONARY DISEASES. In: Tenth Aspen Emphysema Conference: Current Research in Chronic Obstructive Lung Disease, p. 3-25, June 1967.

Experimental data indicate that clearance of inhaled material from the lung depends upon endocytosis, alveolar clearance by surface forces, and mucociliary clearance along the tracheobronchial epithelium. Experimentation with frog lung suggested that alveolar clearance occurred due to movement of dilute and thin (sol) mucus from its point of secretion in type B alveolar cells and Clara cells to various levels up the airway where it is reabsorbed. Microvilli of the ciliated cells may be important in maintaining optimal thickness of the sol layer of the viscoelastic mucus transport system. Observation of the evaginated frog lung supported this model. Damage to such a transport system with reabsorptive failure may help to explain the occurrence of large quantities of secretions in patients with airway disease.

6874 APTIC NUMBER 14747

Kirkwod, D. H. and J. Nutting
AN ELECTRON METALLOGRAPHIC INVESTIGATION OF THE OXIDATION OF LEAD SULFIDE IN AIR BETWEEN 200 AND 350 C. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), 233(4):708-713, April 1965. 11 refs.

The oxidation of lead sulfide in air between 200 and 350 C was investigated by electron diffraction from thick sulfide films and from galena surfaces. The results showed that lead sulfate is stable in air up to about 570 C. Between 200 and 300 C, galena crystals were oxidized in air and the surface products were analyzed by electron diffraction. A film composed of very small crystallites of lead sulfate was initially formed over the surface. This was followed by the appearance of lead oxide in the form of needles. With longer periods of oxidation, a new diffraction pattern appeared which is believed to originate from lead tetraoxysulfate crystals. Above 300 C, the surface gave rise to a complex diffraction pattern which was not identified. The above sequence of products was explained by assuming that after a continuous film of sulfate is formed over the surface, only lead ions can readily diffuse to the top surface. This leads to the formation of lead oxide on the top surface while sulfur builds up in the kernel. When the sulfur reaches a pressure at which it erupts through the sulfate film, the supply of sulfur enables oxysulfate crystals to form. Certain crystals oxidized in the range of 200-300 C did not give this sequence of products. The initial sulfate pattern was followed by one arising from lead mono-oxysulfate. This behavior was found to be associated with surface impurities which were present before oxidation. It was suggested that these impurities prevent the continuous film of sulfate from being established, and sulfur is able to migrate to the top surface through breaks in the film. Mono-oxysulfate is formed as the supply of sulfurous gases decreases.

6875 APTIC NUMBER 14391

Kiselev, A. V.
NATURE OF HYDROCARBON ADSORPTION ON GRAPHITE, OXIDES, HYDROXIDES, AND CHEMICALLY MODIFIED SURFACES. (Prirode adsorbtsii uglevodorodov na grafite, okisyakh, gidrookisyakh i khimicheski modifitsirovannykh poverkhnostyakh). Text in Russian. Gaz. Khromatogr., Tr. Pervoi vses. Konf., Akad. Nauk SSSR, Moscow, 1959, p. 45-80. 61 refs.

Considerations necessary for a better theoretical and practical understanding of chromatographic separation of hydrocarbons are presented. Topics examined are: absorption energy of hydrocarbons on graphitized carbon black and magnesium oxide; absorption energy of hydrocarbons on hydroxides; adsorption isotherms for individual hydrocarbons on a uniform surface; effect of chemical modification of absorbent surface on the absorption of hydrocarbons; effect of geometrical modification of absorbents--creation and alteration of surface--on the absorption of hydrocarbons. It is recommended that further work center on the following items: theory of adsorption forces, calculation of adsorption energy, measurement of heat of adsorption at different temperatures; statistical theory of adsorption equilibria, measurement of heat capacity of adsorption systems; investigation of the state of surface chemical compounds and adsorption complexes using infrared spectra and other new methods; investigation of the geometric structure of adsorbents and structure modification; investigation of the chemical structure of surfaces and their chemical modification; investigation of adsorption equilibria for gas mixtures, especially by the vacuum circulation method using new adsorbents.

6876 APTIC NUMBER 15033

Kistemaker, J., J. Los, and E. J. J. Veldhuyzen
THE ENRICHMENT OF URANIUM ISOTOPES WITH ULTRACENTRIFUGES. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. 2nd, Geneva, 1958, vol. 4:435-438. 4 refs.

The economic value of enriched uranium was calculated, and various separation methods were compared with respect to the cost price of the end product, to capital investment, and to energy consumption. In the case of low enriched uranium, a reduction in the separative power price in dollars/kg total feed is of high importance and is available with the ultracentrifuge method. Annual costs of the ultracentrifuge

method appear favorable in comparison to those for a diffusion plant with the same capacity. One of the most attractive features of the countercurrent centrifuge is the high enrichment per separating element. This results in a short and broad cascade, which permits an easy splitting up in parallel sections. It would be possible to build plants each containing five or ten thousand centrifuges. The entities are only limited by the requirement that the costs for pumps and buildings may not exceed the total price for all the centrifuges. The ultracentrifuge plant, unlike diffusion plants, can be constructed as a rather small unit.

6877 APTIC NUMBER 13609

Klemperer, H. G. and G. R. Haynes
ALTERED SPECIFICITY OF TRANSFER-RIBONUCLEIC ACID NUCLEOTIDYLTRANSFERASE IN THE PRESENCE OF MANGANESE. Biochem. J., Vol. 104:537-544, 1967. 32 refs.

Transfer RNA, (s-RNA) nucleotidyltransferase incorporated cytidine monophosphate (CMP) into phosphodiesterase-treated s-RNA more rapidly in the presence of Mg(2 plus) (10mM) than in the presence of Mn (2 plus) (2mM). Uridine monophosphate (UMP) was incorporated more rapidly in the presence of Mn(2 plus), and a high ionic strength the incorporation of CMP was also more rapid in the presence of Mn(2 plus). The capacity of phosphodiesterase-treated s-RNA for CMP, UMP and adenosine monophosphate (AMP) was increased in the presence of Mn(2 plus). Terminal sequences of more than one UMP or AMP residue were synthesized, but these a typical reactions were inhibited when CTP was added. CMP was incorporated rapidly to form polycytidyl (-pCpC) terminal sequences and then more slowly as longer chains were formed, but very little CMP was incorporated into s-RNA-pCpCpA. CMP was incorporated into phosphodiesterase-treated 5s RNA and ribosomal RNA to form short chains of polyC attached to the primer RNA. This reaction was inhibited by the presence of s-RNA. A small Mn(2 plus) dependent incorporation of CMP was also primed by poly(A), (U) and poly(C). (Authors' abstract modified)

6878 APTIC NUMBER 14576

Kless, Theodore E.
TWO STAGE PULPING PROCESS INCLUDING IMPREGNATING CHIPS WITH AMMONIA, THEN LIBERATING THE AMMONIA AND PULPING WITH MAGNESIUM COMPOUND. (Allied Chemical Corp.) U. S. Pat. 3,350,258. 2p., Oct. 31, 1967. 3 refs. (Appl. Dec. 12, 1963, 6 claims.)

A process relating to the digestion of wood chips or other ligno-cellulose materials to produce free fibers for pulp is proposed. The process involves digestion in an aqueous solution of an ammonium compound, adding a magnesium compound to the solution before the ammonium ligno-sulfonate formation, recovering ammonia from the solution, and continuing the digestion with the magnesium compound solution. Ammonia compounds are known to be effective for cooking liquor for digestion of cellulose materials, but they are economical only if substantial amounts of ammonia can be recovered. This invention provides that recovery in a form whereby the ammonia can be reused for the defibering process.

6879 APTIC NUMBER 16383

Klufas, A. J.
A REVIEW OF CERTAIN ASPECTS OF PRACTICAL GROUNDING TECHNIQUES. Can. Pulp Paper Assn., Tech. Sec., Tech. Paper T358; T358-T361, 1968. 9 refs. (Presented at the 54th Annual Meeting of the Technical Section, Canadian Pulp and Paper Association, Montreal, Quebec, Jan. 23-26, 1968.)

According to the Canadian Electrical Code, grounding in industrial power distribution systems should provide a safe and permanent path for 60-cps faults, lightning surges, and static charges. Four aspects of grounding are examined with respect to design and operating factors that will ensure personnel safety in the pulp and paper industry. These aspects are equipment grounding, static and lightning protection grounding, connection to earth, and testing. It is emphasized that grounding conductors should be large enough to carry maximal ground current for a reasonable time without burning off and that the impedance of the return path for ground fault currents be as low as possible. A metallic circuit enclosure containing circuit conductors can carry a major portion of the return fault current, but additional current capacity should be provided for this current by adding conductors inside the enclosure. Portable equipment should be grounded through a separate ground wire in the connecting supply cable, equal in current capacity to the largest line conductor. To obtain continuous and reliable service from ground connections, good mechanical construction must be supplemented by adequate inspection. All connections above ground surface must be inspected at least once a year. Measurement of the resistance of a ground connection is the only safe way to determine whether a ground is satisfactory. The resistance of a driven electrode should not exceed 25 ohms: lower resistances are often essential.

6880 APTIC NUMBER 14652

Klushin, D. N., O. V. Nadinskaya, and K. G. Bogatina
REACTION OF STANNOUS SULFIDE WITH SULFUR DIOXIDE. (O vzaimodeystvii sul'fida olova s sernistym gazom). Text in Russian. Sb. Nauchn. Tr., Gos. Nauchn.-Issled. Inst. Tsvetn. Metal., no. 15:192-197, 1959. 1 ref.

Results from an experimental study of the reaction of stannous sulfide with SO2 at 550-1100 C are presented and reaction mechanisms are established. Ash weight was found to increase from 550-700 C, reaching about 9.95% of the charge weight at 700 C, then dropping sharply to below 9.2% and continuing to decrease to below 9% at temperatures above 950 C. The weight of ash correlates closely with the stannous sulfate content in the ash, the latter being almost altogether absent for reaction temperatures above 800 C. At temperatures of 800-1000 C, SnS is changed primarily to SnO2 with accompanying reduction of sulfur.

6881 APTIC NUMBER 15014

Knaap, H. F. P. and J. J. M. Beenakker
HEAT CONDUCTIVITY AND VISCOSITY OF A GAS OF NON-SPHERICAL MOLECULES IN A MAGNETIC FIELD. Physica, 33(3):643-670, 1967. 36 refs.

Development of a theory for transport properties of polyatomic gases has been complicated by the angular dependence of the interaction between two molecules and the exchange of energy between translational and rotational degrees of freedom. The fact that in simple polyatomic molecules transport properties are only influenced to a second order in the nonsphericity further complicates theoretical calculations. The influence of a magnetic field on transport phenomena cannot be adequately explained by perturbation calculations of the mean free path theory. A more fundamental description is given in terms of the distribution function of the velocities and angular momenta of the polyatomic molecules. As shown by Kagan and Maksimov, terms that are anisotropic in both velocity and angular momentum space must be included in the distribution function. The work of these authors on heat conductivity and viscosity of O2 is extended to such nonparamagnetic gases as N2. Apart from the change in heat conductivity by the field, there is also a heat flow generated perpendicular to both field and temperature gradient. A new formula is proposed for the change in heat conductivity of O2 with field. The change in viscosity due to the magnetic field is calculated and found to be different from that of heat conductivity.

6882 APTIC NUMBER 16261

Knott, Marta J. and Myron Malanchuk
ANALYSIS OF FOREIGN AEROSOL PRODUCED IN NO2 RICH ATMOSPHERES OF ANIMAL EXPOSURE CHAMBERS. Am. Ind. Hyg. Assoc. J., 30(2):147-152, March-April 1969. 4 refs.

In an earlier toxicological study, monitoring of a chamber in which dogs were exposed to NO2 and ferric oxide indicated the presence of an extraneous aerosol with twice the response of the Fe2O3 aerosol concentration used. The present study was initiated to identify the substance and measure its components. Nitrate, nitrite, and ammonium analyses were performed on water-soluble portions of aersol samples withdrawn from the chamber, both when dogs were present and absent. Analyses revealed that no nitrite salts were present, but that nitrate and ammonium ions were present in appreciable quantities. The relationship between the nitrate and ammonium ions was examined. In every set of samples, the NO3-N content was greater than the NH4-N content, indicating that the foreign aerosol is primarily NH4NO3. Nitrogen dioxide concentrations and dog activity contributed to but did not determine NH4(+) or NO3(-) contents of the samples.

6883 APTIC NUMBER 14556

Kobakhidze, A. G.
ON THE UTILIZATION OF MANGANESE CARBONATE ORES IN THE CHEMICAL INDUSTRY. (No transliteration available.) Text in Georgian. Tr. Gruzinsk. Politekhn. Inst., no. 6:89-97, 1957.

Thermal dissociation of Chiatursk manganese ores was studied with the aim of utilizing them in the chemical industry. The following conclusions are based on experimental results: Manganese carbonate ore dissociates at temperatures of 900-1000 C. Vigorous release of CO2 takes place at 500-900 C, reducing the weight of the ore by about one-third. The total manganese content in the calcined mass was raised to 33% (an increase of 11%). Such enrichment of manganese carbonate ores is of great interest with regard to expanding their utilization in industry.

6884 APTIC NUMBER 15448

Kochergin, V. P., V. M. Savel'yev, and E. P. Asanova
CORROSION OF IRON IN MELTS CONTAINING NITRATES OF LITHIUM, SODIUM, POTASSIUM AND BARIUM. (Korroziya zheleza v rasplavakh, soderzhashchikh nitraty litiya, natriya, kaliya i bariya). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met., no. 10:132-138, 1960. 19 refs.

Corrosion of iron by nitrates was studied and the following order of increasing corrosion rate was established: NaNO3, KNO3, LiNO3; and in equimolar mixtures: NaNO3-Ba(NO3)2, NaNO3-KNO3, NaNO3-LiNO3. Corrosion of iron in fused lithium nitrate and its alloys with sodium nitrate is conditioned by oxidation of the iron not only by molecular oxygen but also by nitrogen oxides, products of hydrolysis of lithium nitrate at high temperature in the presence of trace amounts of water. After conditioning in vacuum, iron corrosion was significantly reduced (20%) in the NaNO3-LiNO3 mixture, increased in NaNO3, and remained the same in KNO3. It is concluded that the rate of iron corrosion in fused nitrates of alkali metals increases as the accumulation of nitrates of sodium and especially potassium increases.

6885 APTIC NUMBER 16429

Kornfeld, G. and E. Weegmann
THE OXIDATION OF SULFUR DIOXIDE IN ULTRAVIOLET LIGHT. (Die Oxydation von Schwefeldioxyd im ultravioletten Licht). Text in German. Z. Elektrochem., 36(9):789-94, 1930. 13 refs.

Sulfur dioxide obtained by dropping concentrated H2SO4 into NaHSO3 was mixed with electrolytically produced oxygen and irradiated with 3130, 3020 to 2970, 2800, 2537, 2300 to 2140, 2070 and 1860 A. The SO2 content was determined by iodometric titration and compared with the SO2 content of a nonirradiated sample. The UV-absorption of SO2 was so complete that the fraction of light which penetrated the layer was negligible. Despite this, however, no reaction was observed at 3020, 2800, or 2537 A. Indication of SO3 formation were obtained only in the shortwave range experiments. It was found that SO3 also absorbed ultraviolet light, which led to its dissociation. For one and the same wavelength, the number of molecules converted per quantum depended on the concentration of the formed SO3. The absorption was more pronounced at 1860 than

2070 A. The reaction speed was independent of the SO2 and O2 concentration. Dissociation of pure SO2, which lead to the formation of SO3 and precipitation of S2, took place at 2070 and 1860 A, but not at 2537 A. No explanation is found for this phenomenon. Further analyses are required.

6886 APTIC NUMBER 15088

Korving, J., H. Hulsman, H. F. P. Knaap, and J. J. M. Beenakker
THE INFLUENCE OF A MAGNETIC FIELD ON THE VISCOSITY OF CH4 AND CF4 (ROUGH SPHERICAL MOLECULES). Phys. Letters, 17(1):33-34, June 15, 1965. 11 refs.

An experimental determination of the influence of a magnetic field on the velocity of CH4 and CF4 is reported. The classical picture of the phenomenon for nonspherical molecules is that the magnetic field gives rise to a precession of the magnetic moment of the molecule around the field direction. A more fundamental description is given in terms of the distribution function of the velocities and angular momenta of polyatomic molecules. The change in the viscosity of CH4 and CF4, which are regarded as rough spherical molecules was measured, and a change was found for both gases. Results show that viscosity change is a function of the magnetic field/pressure. A theoretical treatment of viscosity and heat conductivity in a gas of rough spherical molecules was undertaken by solving the Boltzmann equation containing a magnetic field term. The rough-spherical model has the advantage over the ovelcid model in that the collision process is completely specified.

6887 APTIC NUMBER 15110

Korving, J., H. F. P. Knaap, H. G. Gordon, and J. J. M. Beenakker
THE INFLUENCE OF A MAGNETIC FIELD ON THE TRANSPORT PROPERTIES OF POLYATOMIC GASES: A COMPARISON OF THEORY WITH EXPERIMENTS. Phys. Letters, A, 24(13):755-756, June 19, 1967. 17 refs.

Effects which arise in the transport properties of polyatomic gases under the influence of a magnetic field are explained by a model which takes into account inelastic collisions. The inelastic collision cross-sections, which are calculated from the field dependence of the viscosity, are in excellent agreement with NMR data. (Author abstract modified)

6888 APTIC NUMBER 15465

Korving, J., H. Hulsman, H. F. P. Knaap, and J. J. M. Beenakker
TRANSVERSE MOMENTUM TRANSPORT IN VISCOUS FLOW OF DIATOMIC GASES IN A MAGNETIC FIELD. Phys. Letters, 21(1):5-7, April 15, 1966. 16 refs.

Experimental results are reported of the study of the transverse effect in the case of viscosity in a magnetic field for O2, N2, and HD at room temperature; this effect is similar to the Hall-effect in electrical conductivity. Measurements of pressure differences in a long flat tube were made with a differential manometer for the gases under investigation and were in fair agreement with results of theoretical calculations. It is concluded that, in a magnetic field under experimental conditions, transverse momentum transport occurs in the viscous flow of diatomic molecules and that the type of measurements that were made, make possible the determination of the sign of the molecular gyromagnetic ratio.

6889 APTIC NUMBER 15268

Kovacs, M. A., G. W. Flynn, and A. Javan
Q SWITCHING OF MOLECULAR LASER TRANSITIONS. Appl. Phys. Letters, 8(3):62-63, Feb. 1, 1966. 3 refs.

Q-switching techniques were applied to an investigation of CO2 and N2O molecular laser transitions. A Brewster-angle discharge was used, and the Q-switched laser was operated either with dc excitation of the discharge by means of internal electrodes or with rf excitation by means of external electrodes. The optimum Q-switching performance was achieved in an N2-CO2-HE mixture. It was obtained at the highest mirror rotation speeds. At low speeds multipulsing occurred. The relaxation time for CO2 laser levels is less than 2 msec. The energy storage time in each Q-switched pulse is determined by lifetimes of the CO2 levels and is not less than 0.3 msec. The width of the pulses is less than the response time of the detector and is 20 nsec or less. Accordingly, the power in each Q-switch pulse of 1 mJ energy is about 50 kW.

6890 APTIC NUMBER 16292

Kozhevnikova, N. V. and D. G. Traber
PETROGRAPHIC AND X-RAY EXAMINATION OF IRON OXIDE CATALYST FOR THE PRODUCTION OF SULFURIC ACID. (Petrograficheskoye i rentgenograficheskoye issledovaniye okisno-zheleznogo katalizatora dlya proizvodstva sernoy kisloty). Text in Russian. Zh. Prikl. Khim., 39(6):1272-1275, 1966. 6 refs.

Iron oxide catalysts undergo partial sulfatization by the action of sulfur dioxide and sulfur trioxide at 675-750 C. Roasting the catalyst at 1000 C leads to the formation of nonactive minerals of the iron orthoclase type (aegirite) and solid solutions of iron oxide with quartz. Long-term (100 hrs) treatment of the catalyst at high temperatures with insufficient oxygen causes gradual accumulation of solid solutions of iron oxides with silica, which subsequently leads to a reduction in catalytic activity. X-ray data for catalysts prior to and after high-temperature treatment and after roasting are tabulated.

6891 APTIC NUMBER 16531

Kozirovski, Y. and M. Folman
INFRARED SPECTRA OF N2O ADSORBED ON EVAPORATED FILMS OF CSCL, CSBR AND CSI. Israel J. Chem., 7(5):595-603, 1969. 18 refs.

Infrared spectra of nitrous oxide adsorbed on high-surface films of evaporated CsCl, CsBr, and CsI were investigated at different

surface coverage. On the spectrum obtained with CsCl, the upsilon 3 absorption appeared as a single, asymmetric band at 2235 reciprocal cm, and the upsilon 1 band, as a doublet at the lowest coverages measured. The frequencies of the doublet's components were 1288 and 1272 reciprocal cm. The upsilon absorption band appeared at larger coverages as an asymmetric band at 582 reciprocal cm. On the spectrum recorded for CsBr, the upsilon 3 band appeared as a well-resolved doublet at 2241 and 2233 reciprocal cm and the upsilon 1 band, as a doublet at 1289 and 1263 reciprocal cm. The upsilon 2 band appeared at 582 reciprocal cm and only for larger coverages. In the case of CsI, the upsilon 3 band appeared as a sharp doublet at 2238 and 2227 reciprocal cm and the upsilon 1 mode, as a doublet with maxima at 1287 and 1260 reciprocal cm. The upsilon 2 band appeared as a single asymmetric absorption with a frequency of 576 reciprocal cm. With all spectra, the intensities of the bands depended strongly on surface coverage. There was often a correlation between their behavior on adsorption and on desorption. The multiplicity of the bands is attributed to different adsorption sites or orientations of the molecule on the surface.

6892

APTIC NUMBER 15380

Kraus, K., W. Mueller-Duysing, and H. Neuert
COLLISIONS OF SLOW NEGATIVE IONS WITH CHARGE TRANSFER. Air Force Cambridge Research Labs., Bedford, Mass., Office of Aerospace Research, Report AFCRL-68-0580, 9p., Nov. 1968. 6 refs. Translated from German. (Also: Z. Naturforsch, vol. 16a: 1385-1387, 1961.)
CPSTI: AD 844772

A mass spectrometer was used to observe collision processes of slow ions with other gas molecules in which charge transfers occurred. It was found that collisions of CS(-) ions with SO2 molecules lead to SO2(-) and collisions of NH2(-) with SO2 or CS2 molecules lead to SO2(-) and to CS2(-). Estimates of the different electron affinities (EA) indicate that EA(SO) is about 1 eV and EA(SO2) is only 0.1 eV greater at the most. (Author abstract modified)

6893

APTIC NUMBER 14912

Krevelen, D. W. van and P. J. Hoftijzer
KINETICS OF SIMULTANEOUS ABSORPTION AND CHEMICAL REACTION. Chem. Eng. Progr., 44(7):529-536, July 1948. 13 refs.

Respective differential and semiempirical equations are developed to express two types of chemical absorption: the diffusion of a dissolved component through a stagnant liquid layer with simultaneous moderately rapid or slow chemical reactions, and the diffusion of moving liquid layers through a packed tower with simultaneous very slow reactions. For moderately rapid and slow reactions, the rate of absorption is shown to be determined by the mass transfer of the reactant in the liquid phase and by the rate of its reaction in the liquid. For very slow reactions, such as chemical absorption in packed towers, the absorption rate is determined primarily by the diffusion mechanism of the reactant in the liquid phase. The differential equation is correlated with data for packed towers to obtain the semiempirical equation. This equation was tested on the absorption of carbon dioxide in diethanolamine in a series of experiments presuming a pseudo third-order reaction. The average deviation between measured reaction-velocity coefficients and those predicted was only 21%. In the carbon dioxide absorptions, the coefficient of mass transfer in the gas phase was plotted as a function of the concentration of the reactive liquid component and found to pass through a maximum. The semiempirical equation completely explains the decrease in mass transfer coefficients at high normalities by the influence of viscosity and diffusity.

6894

APTIC NUMBER 14921

Krevelen, D. W. Van and P. J. Hoftijzer
KINETICS OF GAS-LIQUID REACTIONS. PART I. GENERAL THEORY. Rec. Trav. Chim., vol. 67:563-586, 1948. 5 refs.

The general theory of gas-liquid reactions is presented. When a gaseous component is absorbed by a liquid under simultaneous reaction with a component of the liquid, the overall rate of reaction proves to be a dimensionless function of four limiting rates. They are the maximum rate of diffusion of the gaseous component through the liquid film, the maximum rate of diffusion of the liquid-component through the liquid film, the limiting rate of reaction within the liquid film during diffusion, and the maximum rate of reaction within the main body of the liquid. A graphical representation of the theoretical relationship enables one to predict the overall rates of interphase mass exchange under arbitrary conditions, as soon as reaction velocity coefficients and mass transfer coefficients are available. (Author abstract modified)

6895

APTIC NUMBER 15820

Krichevskaya, Ye. L.
KINETICS OF OXIDATION OF SULFUR DIOXIDE OVER VANADIUM PENTOXIDE. (Kinetika okisleniya sernistogo gaza na pyatiokisi vanadiya). Text in Russian. Zh. Fiz. Khim., 21(3):287-300, 1947. 11 refs.

The kinetics of oxidation of sulfur dioxide over vanadium pentoxide at 475-575 C was studied for SO2 concentrations of 3.8-40.1% and O2 concentrations of 5.0-39.7%. A rate equation for the reaction was derived. The value for apparent energy of activation for the forward reaction was found to be 34,000 calories, which corresponded to earlier values. The form of the kinetic equation indicated that the limiting stage is the surface reaction between SO2 and O2. When a technical vanadium catalyst was used in place of V2O5, the rate of the surface reaction increased so much that it ceased to be the limiting stage. The slowest contacting stage was the absorption of oxygen. When the degree of conversion is low, the effect of reagent diffusion rate within the catalyst pores must be taken into account.

6896 APTIC NUMBER 16167

Kul'kova, N. V., N. N. Savodnik, D. M. Dokholov, M. S. Furman, and M. I. Temkin
CATALYTIC ACTIVITY OF PLATINUM IN THE HYDROGENATION OF NITRIC OXIDE. Kinetics Catalysis (USSR) (English translation from Russian of: Kinetika i Kataliz), 10(3):570-571, May-June 1969. 8 refs.

Platinum catalysts were prepared and investigated on various acid-resistant carriers: the activated charccals AR-3, AG-2, and SKT; aluminosilicate in the form of microspheres; and fine-grained corundum. The catalysts contained 1-10% by weight platinum. The specific surface of the carriers and catalysts was determined acccrding to the low-temperature adsorption of krypton and nitrogen. Measurements of the chemisorption of hydrogen were used to determine the surface of platinum on the carrier. The catalytic activity of the previously investigated catalysts in the hydrogenation of nitric oxide was determined in a flow type set-up. Under the experimental conditions, the rate of formation of hydroxylamine did not depend on the grain size of the catalyst and rate of mixing of the solution. This showed that the reaction did not take place in the kinetic region. After definite periods of time, samples of the solution from hydrogenation were collected for analysis. The content of hydroxylamine and hydrazine hydrochlorides and ammonium chloride was determined. The analyses of the solutions indicated that the process of hydrogenation of nitric oxide to hydroxylamine proceeds selectively; only traces of ammonium chloride were detected. It was concluded that the catalytic activity of a unit surface of platinum on the carriers is only slightly lower than the corresponding value for platinum black and is practically independent of the nature of the carrier.

6897 APTIC NUMBER 16004

Landry, Murphy J. and Jerrel M. Lochner
GE-LIDAR SYSTEM. Sandia Laboratories, Albuquerque, N. M., SC-DR-68-17, 29p., Aug. 1968. 1 ref.
CFSTI: PB 182164

A mobile laser radar (LIDAR) system was developed to detect artificial clouds composed of ablative materials from re-entry vehicles and to provide information on their density, trajectories, and the dispersion rates of their constituents. Suggested applications of the system include studies of back scattering in the atmosphere due to Rayleigh and/or aerosols at different altitudes and slant ranges. Studies of near-field back scattering as related to air pollution might investigate the possibility of remote atmospheric sampling to detect air pollution violators. The system consists essentially of a transmitter, receiver, and a recording and electronics section. The transmitter emits the coherent radiation into the atmosphere; at the same time that the target reflects the radiation, the reciever collects a portion of the reflected energy. The recording and electronics section processes the energy into a photographic form. The orientation or position of the target relative to the transmitting and receiving equipment is automatically recorded. The recorded information permits determination of the characteristics and locatio of the target. Data is presented from evaluation studies in which the laser energy was reflected from stationary, slow-velocity, and low- and high-density targets. The targets were atmospheric clouds, terrain, and retroreflectors.

6898 APTIC NUMBER 15819

Lang, George and Walter Marshall
MOESSBAUER EFFECT IN SOME HEMOGLOBIN COMPOUNDS. J. Mol. Biol., 18(3):385-404, 1966. 30 refs.

The electronic environment of the iron nucleus in a number of compounds of rat hemoglobin was studied by Moessbauer spectrometric techniques. In this method, hyperfine structure in ground states and in 14.4 kev excited states of the Fe-57 nucleus are observed by measuring the energy dependence of gamma-ray absorption. Because the hyperfine structure results from interactions between the nucleus and nearby electrons, information can be deduced about the electronic state of the Fe ion. The charge radius of the excited nuclear state differs from that of the ground state, causing a chemical shift in the absorption spectrum and making possible a measurement of the electron density at the nucleus. The excited nucleus has an electric quadropole moment which interacts with unsymmetric charges in its vicinity. Both types of interactions were observed in the ferrous compounds of hemoglobin with oxygen and carbon monoxide, and in reduced hemoglobin. Measurements indicate that strong covalent effects induce charge asymmetry in the d electrons of oxyhemoglobin, despite its nominal low-spin ferrous configuration. In some hemoglobin compounds, complicated Moessbauer absorption spectra result from magnetic hyperfine interactions. The magnetic moments of the nuclear state interact with magnetic fields especially those of unpaired electrons. The spectra then reflect the magnitude and spatial distribution of electron spin and provide information on electron level schemes. The large magnetic hyperfine effect in hemoglobin nitric oxide provide information about the symmetry of its structure and the amount of transfer of the odd electron spin to the iron. The ferric compounds of hemoglobin with CN(-), N3(-), OH(-), H2O, and F(-) all exhibit magnetic interaction. The analyses of the spectra are complex; they yielded information in agreement with and complementary to electron spin resonance data on the N3(-) and F(-) compounds.

6899 APTIC NUMBER 15872

Latchum, John W. Jr. and James S. Connors
REGENERATION OF ABSORBENT. (Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat. 2,404,854. 6p., July 30, 1946. (Appl. Dec. 18, 1944, 15 claims).

A method is described for stripping acidic gases, such as sulfur dioxide, from absorbent amine solutions in a dry or moisture-free condition suitable for marketing as dry gases or even for use in cyclic processes requiring dry reagents. The process is especially valuable used in conjunction with solvent extraction processes for removing nitrogen gas from hydrocarbon gases. Acidic gas is separated from the body of the gas mixture

by reaction with a diethanolamine or xylidine absorbent. The gas mixture is removed from the absorbent free of the acidic gas. The absorbent is passed through a stripping zone which has an inlet and outlet for the absorbent flow. A vaporous, paraffinic hydrocarbon is passed through the outlet. The hydrocarbon has a boiling point well below the boiling point of diethanolamine. Acidic gas and hydrocarbon is removed from the inlet of the stripping zone. The stripped absorbent is removed through the outlet and recycled into the original contacting step. Acidic gas is removed from the vaporous hydrocarbon as the second product of the process and the hydrocarbon is recycled back to the stripping zone.

6900 APTIC NUMBER 15810

Lecher, H. Z. and W. B. Hardy
COMPOUNDS OF TRIALKYLAMINE OXIDES WITH SULFUR DIOXIDE AND TRIOXIDE. J. Am. Chem. Soc., vol. 70:3789-3792, Nov. 1948. 18 refs.

Trimethylamine oxide-sulfur dioxide was prepared and shown to be distinctly different from trimethylamine-sulfur trioxide in its structure and reactions. The latter hydrolyzes to trimethylamine and sulfuric acid, while the former gives dimethylamine, formaldehyde, and sulfurous acid. The reaction of sulfur dioxide on trimethylamine oxide in water yields essentially the same products, and indicates a new method for the degradation of tertiary to secondary aliphatic amines. The reaction of triethylamine oxide with triethylamine-sulfur trioxide gives triethylamine oxide-sulfur trioxide which hydrolyzes in acidic medium to the amine oxide and sulfuric acid and in alkaline medium to diethylamine, acetaldehyde, and sulfuric acid. (Author summary)

6901 APTIC NUMBER 15979

Leventsov, A. B.
NEW DESIGN FOR A CENTRIFUGAL MULTISTAGE ATOMIZER. (Novaya konstruktsiya tsentrobezhnogo mnogostupenchatogo raspylitelya). Text in Russian. Khim. i Neft. Mashinostr., vol. 9:15-17, Sept. 1966. 5 refs.

A new atomizer developed by the Research Institute for Transportation and Petroleum Technology consists basically of a barrel-type atomizer with a four-stage spreader comprised of an inlet device, a rotor, and a stationary deflector. Sample models have been successfully tested. Such devices are expected to find wide application in the chemical industry and elsewhere to meet heat and mass transfer needs. This device is shown schematically and its operation explained.

6902 APTIC NUMBER 16493

Levy, Arthur and F. L. Merryman
A PROGRESS REPORT: FUNDAMENTALS OF THERMOCHEMICAL CORROSION REACTIONS. Trans. ASME (Am. Soc. Mech. Engrs.), 1965:116-122, Jan. 1965. 11 refs. (Presented at the Am. Soc. Mech. Engrs. Winter Annual Meeting, Philadelphia, Nov. 17-22, 1963, Paper 63-WA-107.)

An attempt was made to examine the microstructure of an H2S-O2 flame by the mass spectrometric, flame-sampling technique. In this procedure, a stable flame is set up and stable products removed from specific positions in the flame and passed to the spectrometer for analysis. A microthermocouple is used to obtain compositional and temperature profiles as a function of distance through the flame front. Compositional profiles for three H2S-O2 flames and a typical temperature and velocity profile show that the main temperature rise appears to occur before the visible flame region. However, three experimental problem areas interfere with reliable kinetic interpretation of the data: the lack of any SO2 or S2O2 in the pre-flame region, higher than stoichiometric values of SO2, and the lack of any SO3 detection in the flame or post-flame region. The calculated rate of depletion of H2S in flame was 10 to the minus 8th power, but the experimental value was 0.00027. This implies a radical mechanism of the type H2S + OH yields HS + H2O, where the reaction is erothermic by 22 kcal and the activation energy is 7 to 10 kcal. The measured rate of formation of SO2 was 0.000049. Of primary significance was the face that, in spite of the high temperature of 1773 K, a considerable amount of SO3 was produced, more than can be explained thermodynamically, assuming equilibrium conditions. The rate constant for the homogeneous formation of SO3 may be considerably higher than the rate constant for dissociation of SO3 under flame conditions. Preliminary data are also presented for catalytically produced SO2 and SO3.

6903 APTIC NUMBER 16052

Locket, George Hazlewood
MOLECULAR ASSOCIATION OF AROMATIC HYDROCARBONS WITH THIONYL CHLORIDE, SULPHURYL CHLORIDE, AND SULPHUR DIOXIDE. J. Chem. Soc., 1932:1501-1512, 1932. 30 refs.

The viscosities, densities and heats of mixing for mixtures of thionyl and sulfuryl chlorides and sulfur dioxide with aromatic hycrocarbons were determined at 25 degrees. Comparative determinations were made with cyclohexane, stannic chloride, ether, and ethyl acetate. In contrast to cyclohexane, the aromatic hydrocarbons associated with thionyl and sulfuryl chlorides and sulfur dioxide and behaved like polar liquids which is in contrast to cyclohexane. The hydrocarbons may be electron donors, but it is probable that they can acquire an induced dipole moment from the inorganic molecule. This effect will only be apparent with molecules which are highly unsymmetrical or in which a large electronic shift is localized. Release of the electrons to the nucleus of the hydrocarbon by methylation increases the induction effect and the association. This view explains complex formation with other unionized inorganic molecules. Polarization of the hydrocarbons is a probable explanation of their activity in the Friedel-Crafts reaction, but in view of the complexity of the reaction, it cannot be determined whether the free halides or more complex molecules produce polarization.

6904 APTIC NUMBER 16236

Ludwig, Barbara E. and G. R. McMillan
DISPROPORTIONATION AND COMBINATION REACTIONS OF ISOPROPOXY RADICALS WITH NITRIC OXIDE. J. Phys. Chem., 71(3):762-764, Feb. 1967. 5 refs.

Because the disproportionation:combination ratio of ethoxy radicals with nitric oxide is important in the photochemistry of alkyl nitrites, nitrates, and nitro compounds, isopropoxy-nitric oxide reactions were studied by pyrolyzing diisopropyl and nitric oxide mixtures at 25 to 180 deg. As determined by gas chromatography, the main reaction products were isopropyl nitrite, acetone, and isopropyl alcohol. Traces of acetaldehyde and methyl nitrate were also present. Over the ranges indicated, the following variables had no effect on the acetone: isopropyl nitrite ratio: diisopropyl peroxide pressure, 2.7-14.6 mm; nitric oxide pressure, 2.8-46.9 mm; nitric oxide pressure: peroxide pressure, 0.35-8.58 mm; percent peroxide decomposition, 2.0-12.1%; reaction time, 0.7-14440 min; and added nitrogen, 200 mm. Below 150 deg, product ratios were temperature dependent due to surface reactions. Above 160 deg, the isopropyl nitrite ratio is temperature independent. This constancy together with independence of the ratio of the other variables suggests that the disproportionation:combination ratio is 0.17 at 26 to 180 deg. Like alkyl-alkyl reactions, isopropoxy-nitric oxide reactions show appreciable difference in activation energies for disproportionation and combination processes.

6905 APTIC NUMBER 15417

Madejski, J.
DESIGN OF COOLER CONDENSERS. Brit. Chem. Eng., 4(3):148-153, March 1959. 5 refs.

A cooler condenser is defined as a heat exchanger in which vapor is condensed from mixtures with high concentrations of inert gases; in the process of condensation, the mixture is also cooled. Shell and tube exchangers used as vertical condensers are suitable for this purpose; the cooling fluid flows in the shell, its path being directly by baffles. The flow is at first cross-current, then co-current or counter-current, then cross-current again and so on with respect ot the flow of vapor-gas mixture. When there are no baffles, co-current or counter-current flow will obtain. An improved method of analyzing counter-current flow, which takes into account the total pressure drop on the condensing side, is presented in terms of an extensive series of equations for calculating heat-transfer conditions in a shell exchanger with vertical tubes cooled in counter- or co-current; it is based on the analysis of a single tube of defined inside diameter and effective length. The equations are then applied to the design of a condenser for the liquefaction of chlorine.

6906 APTIC NUMBER 14590

Maitra, Unadas, Yozo Nakata, and Jerard Hurwitz
THE ROLE OF DEOXYRIBONUCLEIC ACID IN RIBONUCLEIC ACID SYNTHESIS. XIV. A STUDY OF THE INITATION OF RIBONUCLEIC ACID SYNTHESIS. J. Biol. Chem., 242(21):4908-4918, Nov. 10, 1967. 23 refs.

Initation and growth of RNA chains in the DNA-dependent RNA polymerase reaction were studied by measuring the incorporation of gamma-p-32-labeled nucleoside triphosphates and C-14 (or alpha-P-32)-nucleoside triphosphates into RNA. The ratio of total nucleotide of RNA synthesized to total initiation is a measure of the average chain length of the RNA produced in the polymerase reaction. The length of RNA chains synthesized is independent of nucleoside triphosphate concentration and of enzyme concentration after extensive RNA synthesis, since both initation and synthesis increase proportionally. However, the average RNA chain length is dependent on DNA template concentration. The rate of RNA synthesis increases more rapidly than RNA chain initiation as the DNA concentration is elevated. The specificity of initation of chains with either ATP or guanosine triphosphate is independent of the above three parameters. The nucleotide penultimate to the nucleoside triphosphate end has been determined with Escherichia coli and bacteriophage T4 DNA as templates. All four nucleotides are found in this position in a nonrandom distribution, although there is a preponderance of pyrimidine over purine nucleotides in this second position of a growing RNA chain. In addition, a number of inhibitors that have been examined for their differential effects on initiation and chain growth. (Authors' abstract modified)

6907 APTIC NUMBER 15937

Makarova, Ye. I., and V. V. Illarionov
INVESTIGATION OF THE ACTIVE COMPONENT OF VANADIUM CATALYSTS BY THE SULFUR EXCHANGE METHOD. (Issledovaniye aktivnogo komponenta vanadievykh katalizatorov metodom obmena seroy). Text in Russian. Sb. Statei Nauchn-Issled. Inst. Udobr. i Insektofung., 1963:68-75. 11 refs.

The exchange of SO3 groups between sulfate and pyrosulfate and the gas phase was studied, and exchange between the gaseous medium and pyrosulfate was established. With an initial sulfate phase present, exchange takes place so that the SO2 partial pressure in the gas is greater than the partial pressure due to pyrosulfate dissociation. In the system V2O5-K2SO4, exchange is observed at a higher temperature, i.e., under conditions where exchange does not take place in the absence of V2O5. This indicates that bonds between V2SO5 and potassium sulfate or pyrosulfate are stable under operating conditions of industrial contact installations. At the outset of exchange, the limiting stage is the exchange reaction itself. Later, depending upon the extent to which the condensed phase is depleted, the diffusion of SO3 from within the condensed phase to the phase interface (where the exchange reaction takes place) becomes the limiting stage. Studies of exchange at 435 and 415 C have shown that with SO2 in the gas phase, conversion of V2O5 to inert vanadium sulfate, in which the SO3 group is not capable of exchange, takes place.

6908 APTIC NUMBER 14555

Malin, N. M.
OBTAINING 100% SULFUR DIOXIDE BY REACTING PYRITE WITH FERRIC OXIDES. (Polucheniye 100%-go sernistogo gaza vzaimodeystviyem kolchedana s okislami zheleza). Text in Russian. Vopr. Polucheniya Sernistogo Gaza iz Kolchedana i Sery, 1957:102-107.

Experiments at 600, 800, and 1000 C revealed that desulfurization of FeS and FeS2 during reaction with Fe2C3 under nitrogen or SO2 proceeds no more slowly than in the combustion of FeS2 in air. Experiments were carried out with flotation pyrite and pyrite cinder produced by burning the same pyrite in air. Other series of experiments used pyrite cinder obtained from the first experimental series after air oxidation. No loss in effectiveness of the process from cycle to cycle was noted. An almost complete sulfur yield in the form of SO2 at industrially acceptable rates was found possible at a temperature of 800 C. One hundred percent yield of SO2 through reaction of S with Fe2O3 was also demonstrated experimentally. Reaction of Fe2O3 with carbonaceous pyrite with 42.14% S and 11.2% C yielded 85.5% SO2 with 41.5% CO. It is concluded that the proposed process is of even greater interest in connection with carbonaceous rather than ordinary pyrite.

6909 APTIC NUMBER 16571

Manabe, K. and K. Kubo
HEAT DECOMPOSITION OF NICKEL ACETATE WITH FOUR CRYSTAL WATERS (Ni(CH3COO)2-4H2O). (Sukusan nikkeru 4-suiwabutsu no netsu-bunkai). Text in Japanese. Kogyo Kagaku Zasshi (J. Chem. Soc. Japan), 69(9):1727-1732, 1966. 5 refs.

The decomposition of Ni(CH3COO)2-4H2O under high temperatures between 100 to 350 C was studied by the use of temperature gravity analysis (TGA), different temperature analysis (DTA), X-ray analysis, ultraviolet analysis, weight analysis, and chemical analysis. The DTA curve of Ni(CH3COO)2-4H2O significantly varied with the change of the thickness of the material layer: there were two peaks in the curve, each one for absorption and emission of the heat when the layer was 2 mm thick; and there were 3 peaks for heat absorption, one peak for heat emission, and a tiny peak immediately before the absorption peak, when the layer was 20 mm thick. The TGA curve of Ni(CH3COO2-4H2O revealed the process of heat decomposition: the dehydration started at 70 C and ended at about 150 C, producing Ni(CH3COO)2 without crystal water; the Ni(CH3COO)2 was stable under the temperature between 150 and 250 C; and then the Ni(CH3COO)2 again started to be decomposed at 250 C, having the maximum reaction velocity at about 300 C and ended at 350 C. During the first process, Ni(CH3COO)2-1/2H2O was produced; during the 3rd process, an intermediate substance (10Ni(CH3COO)2-3NiO) and nickel metal were produced. The techniques of these analytical methods were the same as were shown in the previous reports (Chem. Soc. Jap. J. Indust. Chem. Section 68:1629, 1965 and 69:615, 1966.).

6910 APTIC NUMBER 14565

Manning, P. V. and R. C. Jarnagin
HALIDE ION EFFECTS ON COBALT(III)-CHROMIUM(II) OXIDATION-REDUCTION REACTIONS. J. Phys. Chem., vol. 67:2884-2885, Dec. 1963. 3 refs.

Halide ions accelerate a number of oxidation-reduction reactions. In some cases, the halide forms a bridge between oxidant and reductant, with Br(-) usually causing a larger rate increase than Cl(-). A previous investigation of the reduction of complexes of the type (H3N)5CoL(2 or 3 plus) by (aq)Cr(2 plus) showed that for L equals NH3, the reaction presumably proceeds by an outer sphere mechanism with chloride catalysis. If L equals OAc(-), the reaction proceeds by a bridge mechanism with Cr(II) attack at the adjacent carboxyl group. If L equals fumarate equals FuH(-) equals (O2C(CH)2CO2H(-)), the reaction proceeds by a bridge mechanism with a primary attack by Cr(II) at the remote carboxyl and with lesser interaction at the adjacent carboxyl. Halide-catalyzed reactions in the oxidant complexes (H3N)5CoNH3(3 plus), (H3N)5CoFuH(2 plus), and (H3N)5CoOAc(2 plus) are reported. They are first order in both Co(III) and Cr(II) systems. Though Cl(-) is even more effective than Br(-), either halide increases outer sphere as well as bridge reaction rates, suggesting that the role of the halide is the same for both mechanisms. The activated complex of the bridge mechanism is thought to be of the type ((H3N)5CoFuHCrX(OH2)4) (3 plus) and with the proper geometry of the ligand atmosphere to permit electron transfer. Consequently, the function of the halide is one or both of the following: to make the relaxation time of the ligand geometry more rapid or to raise the energy of the electron to be transferred.

6911 APTIC NUMBER 14887

Mansfield, Edwin and Carlton Hensley
THE LOGISTIC PROCESS: TABLES OF THE STOCHASTIC EPIDEMIC CURVE AND APPLICATIONS. J. Roy. Stat. Soc., 2213(2):332-337, 1960. 14 refs.

In general, the logistic process represents a situation where one member of a closed group acquires some characteristic at a given point in time. The chance that others will acquire the characteristic in a given time interval is proportional to the number already having it and the length of the interval (the coefficient of proportionality being the same for all). The process is often used to represent the spread of an epidemic. Two important measures of how the probability distribution for the number of infected persons varies over time are the stochastic mean and the epidemic curve. The stochastic mean shows the expected number of infected persons at each point in time and the epidemic curve shows the rate of change of the expected number. Extensive tables of the epidemic curve are computed, and can be used to derive the higher moments of the probability distribution of the number of infected persons.

6912 APTIC NUMBER 16204

Manvelyan, M. G., G. O. Prigoryan, and S. A. Gazaryan
JOINT RECOVERY OF LOW CONCENTRATIONS OF SULFUR DIOXIDE AND

NITROGEN-CONTAINING GASES BY ALKALIS AND CARBONATES. COMMUNICATION I. (Sovmestnoe ulavlivanie nizkokontsentrirovannykh sernistykh i nitroznykh gazov shchelochami i karbonatami). Text in Russian. Izv. Akad. Nauk Arm. SSR Khim. Nauk, 12(3):166-174, 1959. 16 refs.

Oxidation of sulfite to sulfate by a mixture of gases was studied experimentally as a preliminary step in the eventual development of a process for recovery of waste gases in industrial processes. The gas mixture used was a combination of nitric oxide, nitrogen dioxide, nitrogen, and oxygen. The oxides of nitrogen apparently acted as initiators in the process of converting sulfite to sulfate. The more soluble sulfites (i.e., ammonium and sodium sulfites) were more readily oxidized than calcium and barium sulfites.

6913 APTIC NUMBER 16195

Manvelyan, M. G., G. O. Grigoryan, S. A. Gazaryan, G. S. Papyan, S. S. Karakhanyan, and L. S. Melik-Ispaelyan
SIMULTANEOUS ABSORPTION OF LOW CONCENTRATIONS OF SULFUR DIOXIDE AND NITROGEN-CONTAINING GASES BY ALKALIES AND CARBONATES. COMMUNICATION 6. EFFECT OF INHIBITORS ON THE OXIDATION OF CALCIUM SULFITE TO SULFATE BY OXYGEN OF THE AIR IN THE PRESENCE OF TRACES OF NITROGEN OXIDES. (Sovmestnoe ulavlivanie nizkokontsentrirovannykh sernistykh i nitroznykh gazov shchelochami i karbonatami. Soobshchenie VI. Vliyanie ingibitorov na protsess okisleniya sul'fita kal'tsiya v sul'fat kislorodom vozdukha v prisutstvii sledov okislov azota). Text in Russian. Izv. Akad. Nauk Arm. SSR Khim. Nauk, (14(1):27-33, 1961. 2 refs.

It was confirmed that paraamino phenol, paraphenylene diamine, furfural, hydroquinone and glycerol are strong inhibitors of oxidation of sulfites to sulfates by oxygen in the air. Phenol had a weak inhibitory effect. When calcium sulfite was oxidized in air in the presence of traces of nitrogen oxides (the inhibitor being present in the amount of 0.5% of the weight of the sulfite), paraamino phenol and glycerol had no inhibitory effect on the reaction, while paraphenylenediamine, hydroquinone, and furfural inhibited it only slightly. An increase in the concentration of the inhibitor to 1% led to an increase in the oxidation of calcium sulfite to sulfate; further increase in inhibitor concentration had only a slight effect on the degree of oxidation. With a combined flow of the gas mixture, the inhibitory effect was more marked.

6914 APTIC NUMBER 16209

Manvelyan, M. G., G. O. Grigoryan, S. A. Gazaryan, G. S. Papyan, and R. L. Mirumyan
SIMULTANEOUS COLLECTION OF LOW-CONCENTRATION SULFUR DIOXIDE AND NITROGEN OXIDE GASES WITH ALKALIES AND CARBONATES. PART III. OBTAINING GYPSUM IN A LARGE-SCALE LABORATORY ARRANGEMENT. (Sovmestnoye ulavlivaniye nizkokontsentrirovannykh sernistykh i nitroenykh gazov shchelochami i karbonatami. Soobshcheniye III. Izucheniye protsessa polucheniya gipsa na ukrupnennoy laboratornoy ustanovke). Text in Russian. Izv. Akad. Nauk Arm. SSR Khim. Nauk, 12(5):313-323, 1959. 3 refs.

The production of gypsum by simultaneous absorption of low-concentration sulfur dioxide and nitrogen oxide gases with carbonates was studied using large-scale laboratory equipment. It was established that 100% gypsum can be obtained with SO2 concentrations up to 1.5% and nitrogen oxide concentrations from 0.05 to 0.1%. When the solid-to-liquid phase ratio was increased from 1:100 to 1:20, no reduction in intensity of the process was detected, nor did the degree of conversion of SO3 to SO4 decrease. Similar results were obtained when the gas flow rate was reduced. When a calcium carbonate suspension was replaced with calcium hydroxide, the process rate was reduced by only 10-20%. The use of limestone both in the form of a suspension and in the form of chunks in a water irrigation apparatus also leads to the formation of 100% gypsum, the reaction rate being somewhat lower in the latter case. The possibility of utilizing a circulating liquid was demonstrated. Introduction of the gas mixture at several points was shown to significantly increase the reaction rate. Chemical, thermal, and x-ray analyses showed the gypsum formed in these experiments to be identical with medicinal gypsum.

6915 APTIC NUMBER 14754

Marchal, Germaine
RESEARCH ON THE DECOMPOSITION OF METALLIC SULFATES BY HEAT. DISSOCIATION OF MAGNESIUM AND BERYLLIUM SULFATES AND THEIR COMBINATIONS WITH POTASSIUM SULFATE. (Recherches sur la decomposition des sulfates metalliques par la chaleur. Dissociation des sulfates de magnesium, de glucinium et de leurs combinaisons avec le sulfate de potassium). Text in French. J. Chim. Phys., vol. 22:493-517, 1925. 26 refs.

The range of temperatures and pressures was measured from the beginning of the decomposition of magnesium sulfate at 880 to 1175 C. There was a break in the rise of temperature and pressure in the region of 1155-1165 C near the melting point. The melting point was shown to be 1155 C as determined in a special electric furnace. From the temperature-pressure diagrams, it was possible to calculate the partial pressures of sulfur trioxide, sulfur dioxide, and oxygen in the range 950 to 1190 C and the dissociation curve, temperature versus pressure. The reaction heat of decomposition varied from 71 cal between 1000 and 1050 C to 62.3 cal between 1084 and 1100 C. The same types of experiments were done for beryllium sulfate. Decomposition set in at 610 C and proceeded more rapidly at 700 C. Decomposition occurred according to the reaction: 5 BeSO4 yields SO3.5BeO + 4SO3. Again, a curve of pressure versus temperature was recorded between 590 and 830 C. The partial pressures of the gases (SO2, SO3, O2) given off in this range were also determined. The heat of decomposition averaged 41 cal. The double salt of magnesium and potassium sulfates was crystallized from pure single salts. Its melting point averaged 751 C.

6916 APTIC NUMBER 16559

Marmershtein, I. I. and V. A. Shnaidman
THE STABILITY CRITERIA FOR FINITE-DIFFERENCE CONTAINMENT-

DIFFUSION EQUATION. (Kriterii ustoychivosti konechnoraznostnogo uravneniya diffuzii primesi). Text in Russian. Fiz. Atm. i Okeana (Moscow), 5(10):1075-1078, Oct. 1969. 5 refs.

In the course of investigating the stability of solutions of finite-difference equations, the problem of finding those relations which must be satisfied by the coefficients of the difference equation was considered in order that, with any given bounded 'driving function', the corresponding solution of that equation be bounded throughout the infinite space and on the semi-infinite positive time axis. Stability criteria was obtained for solutions of the finite-difference approximation of the boundary-value problem specifying the dispersion of an admixture in the atmosphere due to diffusion and to turbulent mixing in the horizontal and both vertical planes.

6917 APTIC NUMBER 14536

Mars, P. and J. G. H. Maessen
THE MECHANISM OF THE OXIDATION OF SULPHUR DIOXIDE ON POTASSIUM-VANADIUM OXIDE CATALYSTS. Proc. Intern. Congress on Catalysis, 3rd, vol. 1:266-281, 1965. 25 refs. (Amsterdam, 1964).

Many authors have suggested that the chemisorption of oxygen plays an important role in therate-determining step of the oxidation of sulfur dioxide on vanadium catalysts. From kinetic measurements it is clear, however, that besides the partial pressure of oxygen, the pressures of SO2 and SO3 also influence the rate of reaction. To gain more information about the mechanism, the catalyst and the gas phase were carefully analyzed, both in the course of the reaction SO2 plus 1/2 O2 yields SO3, and after SO2, O2, and SO3 reached equilibrium. In making these analyses, it is necessary to ensure that: a) the reaction takes place in a differential reactor; b) the concentration gradient of the reactants in the catalyst pores may be neglected; and c) no change can occur in the catalyst composition when the catalyst is being removed from the reactor. The results show that the equilibrium between the sulfur oxides in the gas phase and the vanadium oxides dissolved in potassium pyrosulfate is always fully reached: SO2 plus 2V(V) plus O(2-) yields SO3 plus 2V(IV). The rate of the sulfur dioxide oxidation is determined by the rate of the chemisorption of oxygen to the surface, by which V(IV) is converted to V(V). It is shown that the apparently very complicated kinetic pattern of the reaction can be logically explained on the basis of this mechanism. An audience discussion is appended. (Author abstract modified)

6918 APTIC NUMBER 15144

Martensson, H., K. E. Holmberg, C. Lofman, and E. I. Eriksson
SOME TYPES OF MEMBRANES FOR ISOTOPE SEP ATION BY GASEOUS DIFFUSION. United Nations, New York, . ec. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:395-404. 8 refs.

Two types of plane membranes for gaseous diffusion were tested by measuring separation efficiency, which depends on mean pore radius and permeability; the measurement techniques are described. Anodic aluminum oxide membranes, when completely oxidized, are rather fragile and can withstand only weak bending stresses. Partially oxidized membranes possess considerably greater strength, particularly in bending. A technique which overcomes the various difficulties in carrying out a successful partial oxidation is described. Results of experiments on this basic type of membrane show that the optimum relation between separation efficiency and permeability of the membrane is given by electrolysis at 30 v in 5-10% sulfuric acid at 20-25 C. This relationship is considerably improved by etching the membrane after the anodic treatment; the etching increases permeability by an increase in the pore size. Thus, in anodized aluminum membranes, permeability varies proportionally with pore size, while in sintered membranes the relationship is linear. These considerations are discussed in relation to recent investigations on porous anodic aluminum oxide coatings. Exposure of such membranes to uranium hexafluoride improved separation efficiency and only slightly decreased permeability. In considering reinforced sintered membranes made from powder obtained by electric-arc sputtering, a method is described which makes it possible to prepare very thin sintered plane membranes of satisfactory strength. The method is based on reinforcement of the membrane by a fine wire gauze; details of membrane preparation, characteristics, and testing are given.

6919 APTIC NUMBER 15312

Martin, Hans
CONVECTION PROCESSES IN THE GAS CENTRIFUGE. THERMAL CONVECTION IN A STRONG GRAVITATIONAL FIELD. (Konvektionsvorgaenge in der Gaszentrifuge). Text in German. Z. Elektrochem., 54(2):120-129, March 1950. 12 refs.

The outflow of a gas between two parallel plates whose temperature is above ambient temperature is calculated. The gas is subjected to a very strong gravitational field parallel to the plate. Due to the large pressure gradient the gas expands, causing it to cool to ambient temperature if no adequate amount of heat is supplied. Since condition is fulfilled in the immediate vicinity of the heated plates, it is hypothesized therefore that a convection occurs along the plates; in the center between them, the gas is not heated and thus no convection takes place. The convection was calculated by using aerodynamic and thermodynamic equations, results showed that the maximum volume flow is associated with an optimum plate distance at which the two convections along the plates meet. A numerical example is calculated for neon and uranium hexafluoride.

6920 APTIC NUMBER 14592

Martin, Ronald L. and John A. Grant
DETERMINATION OF SULFUR-COMPOUND DISTRIBUTIONS IN PETROLEUM SAMPLES BY GAS CHROMATOGRAPHY WITH A COULOMETRIC DETECTOR. Anal. Chem., 37(6):644-649, , May 1965. 18 refs.

Gas chromatography with coulometric detection has proved to be an effective means for characterizing sulfur distributions,

even though individual compounds generally cannot be determined. The detection system responds to sulfur compounds but not to hydrocarbons. Under optimum conditions, it quantitatively determines individual sulfur compounds at sulfur levels down to 5 ppm. Sulfur compounds are eluted from a silicone-rubber column nearly in order of boiling point. Characteristic sulfur distributions are illustrated by determinations on gasoline, coke-still naphtha, catalytic cycle oil, whole crude, and the heavy naphtha, kerosene, and gas oil fractions from the crude. Because all sulfur types are often present in virgin samples, identification of individual members is difficult, and distributions by boiling point must suffice. In the refined samples, however, sulfur distributions are usually less complex, and some individual components or groups of components can be determined or at least estimated. A combination technique of linear elution adsorption chromatography, gas chromatography, and mass spectrometry is recommended for more informative results.

6921 APTIC NUMBER 15466

Hasanuse, Shinobu and J. M. Smith
ADSORPTION RATE STUDIES - INTERACTION OF DIFFUSION AND SURFACE PROCESSES. Am. Inst. Chem. Engrs. J., 11(1):34-40, Jan. 1965. 12 refs.

The adsorption of a component of a gas mixture on a solid particle is described by a three-step mechanism which includes diffusion from the main body of the gas phase to the external surface of the particle, diffusion into the particle, and adsorption on the pore surface. In the general case, all three steps contribute to the overall rate measured in terms of concentration in the bulk gas stream. Analytical solutions were obtained for adsorption rates when the overall rate is determined by one of three steps for two-resistance cases of intraparticle diffusion and external diffusion surface adsorption and for the general three-resistance case solved in integral form. A gas mixture containing a single adsorbable component flows through a bed of solid particles under isothermal and isobaric conditions at a constant superficial velocity. The particles are spherical and the concentration of adsorbate in the entering stream is known. The major assumptions are that the adsorption is proportional to the gas phase concentration and independent of the fraction of the surface covered with adsorbate. Thus, the equilibrium relationship between adsorbed molecules and those in the gas phase is linear. Axial diffusion in the bed is negligible with respect to bulk flow. Concentration gradients in the radial direction in the gas phase are negligible. Initial equations, assumptions, and solutions are give for several variations of the problem of concentration as a function of time in the gas phase leaving a fixed bed of porous particles.

6922 APTIC NUMBER 16023

Mascitti, Vincent R.
A SIMPLIFIED EQUILIBRIUM HYDROCARBON-AIR COMBUSTION GAS MODEL FOR CONVENIENT USE IN AIR-BREATHING ENGINE CYCLE COMPUTER PROGRAMS. Virginia Univ., Charlottesville, Dept. of Aerospace Engineering, Thesis (M. Aerospace Eng.), 1967(?), 44p. 11 refs. N69-19694

A simplified hydrocarbon-air combustion gas model was developed for use in engine cycle computer programs. The generalized model reduces to the hydrogen-air system as well as dissociating air. The exclusion of chemical species containing atomic nitrogen allows a considerable simplification of the composition equations. The thermodynamic properties of stoichiometric combustion of the kerosene-air and hydrogen-air systems are computed with the simplified model and are compared with more comprehensive gas models. In addition, the effect of the neglected chemicals species on the performance of an idealized subsonic combustion ramjet is presented. The simplified gas model was used to define the limiting conditions for solid carbon and ammonia formation for rich gas mixtures. A computer program listing of the simplified gas model calculation procedure is presented. (Author abstract modified)

6923 APTIC NUMBER 15084

Massignon, D.
CHARACTERISTICS OF BARRIERS THAN CAN BE USED FOR ISOTOPE SEPARATION BY GASEOUS DIFFUSION. UNITED NATIONS, New York Proc. U. N. Interm. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958. vol. 4:388-394. 17 refs.

Coarse pores and microscopic cracks impair the practical usefulness of barriers for the separation of binary gas mixtures. It is shown that experimental methods for studying the structure of barriers lead to theoretical representation of the structure and to formulae for detecting defective barriers. Formulae are based on effective pore radius for molecular flow, for viscous flow, for intermediate cases, and for separation; and on distributions of pore sizes as determined by the B.E.T. method, the mercury method, and the small-angle scattering of X-rays. The equations are illustrated by application to a normal barrier and 'patholcgical' barriers.

6924 APTIC NUMBER 11192

Massignon, D.
ON THE THEORY OF THE SEPARATION OF CONSTITUENTS FROM A GASEOUS ISOTOPIC MIXTURE ACROSS A POROUS BARRIER. (Sur la theorie de la separation des constituants d'un melange gazeux isotopic par diffusion a travers une barriere poreuse). Text in French. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. D. C. Nier (eds.), New York, Interscience, 1958. Chapt. 42, p. 524-535. 16 refs.

In Present and deBethune's theory for the separation of gas mixtures flowing through a porous barrier, the pores are long capillaries, cylindrical, and of circular cross section. The reflection of the gas molecules against the walls follows Knudsen's law. For binary mixtures, a similar separation theory was derived for porous barriers whose pores are short, tortuous, and have various shaped cross sections. The reflection of the molecules may also deviate from the usual cosine law. (Author abstract modified)

6925

APTIC NUMBER 16257

Mathias, L. E. S., A. Crocker, and M. S. Wills
LASER OSCILLATIONS AT SUBMILLIMETRE WAVELENGTHS FROM PULSED GAS DISCHARGES IN COMPOUNDS OF HYDROGEN, CARBON AND NITROGEN. Electron. Letters, 1(2):45-46, April 1965. 8 refs.

Oscillations at a number of wavelengths between 126 and 373 microns were obtained with a pulsed discharge through dimethylamine at low pressure. The stronger lines in this stimulated emission spectrum were obtained with many other volatile compounds containing hydrogen, carbon, and nitrogen, and with mixtures of hydrogen and bromine cyanide, and methane and ammonia. A new spectrum (four lines between 181 and 205 microns) was obtained with a mixture of deuterium and bromine cyanide. Oscillations at fourteen new wavelengths between 126 and 373 microns were obtained in these experiments. Seven of the wavelengths lie in the region of 200 microns, where no stimulated emission sources were previously available. The radiation was tentatively attributed to HnCN with n greater than one.

6926

APTIC NUMBER 15402

Mathias, L. E. S. and A. Crocker
STIMULATED EMISSION IN THE FAR INFRA-RED FROM WATER VAPOUR AND DEUTERIUM OXIDE DISCHARGES. Phys. Lett., 13(1):35-36, Nov. 1, 1964. 4 refs.

Recent work has shown that a pulsed electrical discharge through water vapor or deuterium oxide at low pressure produces laser oscillations in the far infrared. Twelve oscillation wavelengths between 23 and 119 microns have been listed for the water vapor discharge; two oscillation wavelengths, 36.3 and 72.7 microns, have been listed for the D2O discharge. Stimulated emission spectra in the far infrared were obtained at many more wavelengths for water vapor and deuterium oxide in order to obtain more complete data for the interpretation of molecular processes that are involved. Calibration of the spectrometer with other lasers allowed wavelengths to be measured with 0.05-0.1% error. The radiating molecules or radicals have not been identified. With water vapor flowing through the tube, oscillations were obtained at 32 wavelengths in the range of 16-121 microns. Oscillations were optimum at a gas pressure of 1 torr and at charging voltages between 16 and 21 kV. With deuterium oxide vapor flowing through the tube at a pressure of 1 torr, oscillations were obtained at 16 wavelengths in the range 33-108 microns.

6927

APTIC NUMBER 15788

Matsubara, Teruo and Takeshi Mori
STUDIES ON DENITRIFICATION. II. NITROUS OXIDE, ITS PRODUCTION AND REDUCTION TO NITROGEN. J. Biochem., 64(6): 863-871, 1968. 16 refs.

The role of N2O in denitrification and the reduction of N2O to N2 in Pseudomonas denitrificans were studied by manometric and gas chromotographic techniques with lactate as the hydrogen donor, resting cells produced N2O and N2 from nitrite. The product of the initial stage of the reaction was N2O, later reduced to N2. No lag period in N2O reduction was observed when lactate was the hydrogen donor and N2O the substrate. Azide, cyanide, and 2,4-dinitrophenol at low concentrations inhibited the conversion of N2O to N2. Only N2O was produced from nitrite in the presence of an adequate concentrations of any of these inhibitors, indicating that N2O is probably a precursor in the formation of N2 from nitrite in Pseudomonas denitrificans. The ratio of activity for the reduction of N2O to N2 to that of the reduction of nitrite to N2O is about 4 at pH7.0, the optimum pH for N2O reduction. The apparent Michaelis constant for N2O is 0.00003-0.00006 M. The strong inhibition of nitrous oxide reduction by monoiodoacetate and CuSO4, and a 47-48% inhibition by CO (in the dark), suggest that the enzyme catalyzing the reduction contains heavy metals and thiol. The reaction appears to be a heterogeneous one, with activity lost on simple cell disruption. Only N2O was produced from nitrite by crude extracts prepared by Sonic disruption of the cells. (Author abstract modified)

6928

APTIC NUMBER 14918

McBride, Bonnie J., Sheldon Heimel, Janet G. Ehlers, and Sanford Gordon
THERMODYNAMIC PROPERTIES TO 6000 K FOR 210 SUBSTANCES INVOLVING THE FIRST 18 ELEMENTS. National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center, NASA SP-3001, 328p., 1963. 336 refs.
CFSTI: N63-23715

Consistant tables of thermodynamic properties at temperatures from 0 to 6000 K were compiled for 210 gaseous compounds and condensed species involving the elements with atomic numbers from 1 to 18 (i.e., hydrogen, helium, lithium, beryllium, boron, carbon, nitrogen, oxygen, fluorine, neon, sodium, magnesium, aluminum, silicon, phosphorus, sulfur, chlorine, and argon). The tables give the following thermodynamic functions for the standard state: heat capacity at constant pressure, sensible enthalpy, entropy, sensible free energy, the sum of sensible enthalpy and chemical energy at 0 K, as well as values of the enthalpy changes and the logarithms of the equilibrium constants. The latter two functions are given for the reactions of formation of the substances from a set of assigned reference elements and from these elements in their atomic gaseous state. The functions for most of the gases were generated from molecular data, while the functions of most of the condensed species are based on selected experimental data that were smoothed and made self-consistent. (Author summary modified)

6929

APTIC NUMBER 15829

McCaa, D. J. and J. H. Shaw
THE INFRARED SPECTRUM OF OZONE. J. Mol. Spectr., 25(3):374-397, 1968. 18 refs.

Fourteen bands of ozone between 500 and 3300 reciprocal cm were identified and values of the vibrational anharmonic constants were determined. The integrated band absorptances (IBA) of many of these bands were measured from spectra of a 32-m path of ozone-oxygen mixtures containing up to 30 atm cm ozone near 25 C. The dependences of the band absorptances on the ozone concentration and total pressure are described. The strengths of nine of the bands are given. It is shown that a statistical band model describes the behavior of the bands reasonably well. However, if an accuracy of better than 10% is required, more precise descriptions are required. These can be obtained by fitting empirical expressions containing more than two constants or by applying the band models to narrow spectral intervals in the band rather than to the entire band.

6930 APTIC NUMBER 15016

McCourt, F. R. and R. F. Snider
SENFTLEBEN-BEENAKKER EFFECT FOR THE VISCOSITY OF A DILUTE GAS OF DIAMAGNETIC DIATOMIC MOLECULES. J. Chem. Phys., 47(10): 4117-4128, Nov. 15, 1967. 44 refs.

The effect of an external magnetic field on the viscosity of a dilute gas of rotating diamagnetic diatomic molecules is presented mathematically. A complete tensorial development in irreducible Cartesian tensors is given, the rotational states being treated quantum mechanically and the effect of inelastic collisions included. The magnetic-field dependence is given in terms of reduced square-bracket integrals and the variable H/p, where H is the magnetic-field strength and p, the equilibrium pressure of the gas. In this way it is possible to include the cross effects existing between shear and bulk viscosities and which arise only in the presence of a magnetic field. (Author abstract modified)

6931 APTIC NUMBER 15050

McCourt, F. R. and R. F. Snider
THERMAL CONDUCTIVITY OF A GAS OF ROTATING DIAMAGNETIC MOLECULES IN AN APPLIED MAGNETIC FIELD. J. Chem. Phys., 46(6):2387-2398, March 15, 1967. 55 refs.

The effect of an applied magnetic field on the thermal conductivity of a gas of rotating diamagnetic molecules was determined with the rotational states treated quantum mechanically. The anisotropic part of the thermal conductivity tensor is given in terms of square-bracket integrals and the ratio of the magnetic field to the equilibrium pressure of the gas. The square-bracket integrals to be determined are expressed in terms of reduced relative and center-of-mass velocities. The ratio of the saturation values of the anistropic thermal conductivity when the applied field is parallel to and perpendicular to the temperature gradient is found to be two-thirds. Also, a transverse heat flux or Righi-Leduc effect for gases is discussed briefly, and shown to vanish at infinite and zero fields, attaining a maximum somewhere between. (Author abstract modified)

6932 APTIC NUMBER 15874

McKinnis, Art C.
SOLVENT EXTRACTION. (Union Oil Co. of Calif., Los Angeles) U. S. Pat. 3,350,470. 7p., Oct. 31, 1967. 9 refs. (Appl. Dec. 1, 1961, 8 claims).

A solvent extraction method is described for separating diaromatic hydrocarbons from monoaromatic hydrocarbons of petroleum origin. The method comprises a liquid-liquid extration technique, employing liquid sulfur dioxide and lower alkane solvents, preferably normal alkanes having 5 to 10 carbon length chains. Monomethylnaphthalene is separated from similar boiling monoaromatic and nonaromatic hydrocarbons by contacting the mixture continuously with liquid sulfur dioxide at -20 to 0 C and concurrently with a saturated aliphatic hydrocarbon liquid boiling in the temperature range 95-350 F. A rich extract phase of liquid sulfur dioxide is formed containing part of the hydrocarbon mixture enriched in monomethylnaphthalene. Also formed is a raffinate phase containing the remaining hydrocarbon mixture, the saturated aliphatic hydrocarbon liquid and a small amount of sulfur dioxide. Sulfur dioxide is evaporated from the extract to form a sulfur dioxide overhead product and a hydrocarbon bottom product enriched with monomethylnaphthalene. The sulfur dioxide overhead product is liquified to form liquid sulfur dioxide and recycled. The extraction of 2-methylnaphthalene from a like-boiling hydrocarbon mixture is accomplished in the same way. The method has general application for the preparation of feedstocks for thermal and catalytic dealkylation processes.

6933 APTIC NUMBER 15080

Meares, P.
THE SOLUBILITIES OF GASES IN POLYVINYL ACETATE. Trans. Faraday Soc., vol. 54:40-46, 1958. 8 refs.

The solubility coefficients (s) of helium, neon and hydrogen in polyvinyl acetate were determined between 8 and 40 degrees by establishing equilibrium between the polymer and the gas phase and then desorbing the dissolved gas into a known large volume. Gas pressures up to 20 cm Hg were used and Henry's law was always obeyed. Plots of log (s) against 1/T are linear above the glass temperature (Tg) but convex to the 1/T axis below this, passing through minima at about 20 degrees. It is concluded that below Tg there are regions of minimum density in the polymer which constitute high energy sorption sites into which gas molecules preferentially penetrate. These regions of low density are not large enough for the gas molecules in them to be thermodynamically similar to molecules free in the gas phase. The data are compared with solubility coefficients for the same systems previously determined from diffusion experiments. The two sets of data agree above Tg, but below Tg the values from the equilibrium experiments are greater than those from the diffusion experiments. It is inferred from this that the gas molecules sorbed into regions of minimum density, contribute only little to

the diffusion flux below Tg. There is no evidence for a contribution to the flux from convective flow in the low density regions. (Author abstract modified)

6934 APTIC NUMBER 15085

Mellen, A. W.
CRYOGENICS IN GAS PROCESSING. Oil Gas J., 63(26):96-100; 102, June 28, 1965.

Recent developments in the cryogenic processing of natural gas are revieved. Cryogenic technology is distinguished by its insulation techniques, the most widely known of which is the cold box; by its specialized metallurgical requirements, which depend on the use of various modified steels; and by the need for particularly high thermodynamic efficiency. The technical features of the helium recovery process, presently the greatest of of cryogenics in natural gas processing, are explained, and a flow diagram of the operation is given. Because helium plant construction is diminishing, interest in the cryogenics of liquefied natural gas (LNG) is increasing rapidly, with emphasis on peak-shaving and ocean transportation operations. In LNG plants, interest has centered on cascade-type systems; such a system using propane, ethylene, and methane as the cascading refrigerants is described. The recently-developed use of an expansion-engine cycle in conjunction with existing pressure-letdown situations to provide refrigeration for natural gas liquefaction is also considered, with reference to its application in a simple Claude cycle. The economic and technical aspects of using the cold from LNG revaporization in the liquefaction of industrial gases for distribution is currently under study. Another potential application of cryogenics in the gas industry is the reduction of the nitrogen content of natural gas; nitrogen-rejection techniques have been developed in helium recovery plants and may change the status of gas fields that are not considered economic at present because of high nitrogen content.

6935 APTIC NUMBER 15103

Mercer, S.
CHEMICAL ENGINEERING BELOW 70 K. Chem. Process Eng., 45(10):555-559, Oct. 1964. 8 refs.

Cryogenics and the engineering and purity problems involved in attaining very low temperatures are discussed. Hydrogen, helium, and neon, with boiling points between 4.2-27 K, are the true cryogenic fluids and are vital for meeting increasing demands for lower temperatures. The prime object of producing very low temperatures is refrigeration; the primary uses of refrigeration are enumerated. Refrigeration in a cryogenic cycle is produced in accordance with load requirements and may be generated in various ways. There are two basic types of refrigeration cycles; those in which the working substance is made to perform work and those in which it is not. Four basic cryogenic processes are reviewed: the Joule-Thomson cycle, the expansion turbine cycle, gas separation, and hydrogen distillation. The major cryogenic processes are the separation of mixtures of gases such as hydrogen and carbon monoxide, large-scale manufacture of deuterium by hydrogen distillation for the production of heavy water, production of liquid hydrogen as a rocket-fuel, refrigeration of bubble chambers, refrigeration of moderator chambers in nuclear reactors, refrigeration of superconductors and magnetohydrodynamic generators, and the small-scale production of liquid helium and hydrogen. The problem of gas purification is common to all cryogenic processes. The removal of the bulk of the impurity presents little difficulty as it can be absorbed in scrubbers or deposited on the heat transfer surface of regenerators. However, a regenerator will purify only to the equilibrium concentration of the impurity at the lowest temperature. This can be avoided by installing a suitable surface-active material to absorb the impurity at a relatively high temperature (70 K). Careful design of components, and the minimum use of areas of metal, can reduce conduction losses to an absolute minimum. This maintains a high efficiency in the exchange of heat and the insulation of low-temperature components.

6936 APTIC NUMBER 15784

Michael, Arthur and Nathan Weiner
THE MECHANISM OF THE SULFONATION PROCESS. J. Am. Chem. Soc., vol. 58:294-299, Feb. 1936. 10 refs.

The role of sulfuric anhydride in reactions between ethylene and fuming sulfuric acid was studied, and reaction products determined. When the concentration of sulfuric anhydride did not exceed that necessary to form pyrosulfuric acid, one mole of ethionic acid was formed for each mole of pyrosulfuric acid. When anhydride was in excess, carbyl sulfate was formed from the reaction mixture in the ratio of one mole to two of sulfur trioxide or to one of S2O6. The results demonstrate that the reaction of fuming sulfuric acid with ethylene does not, as proposed, proceed by addition of H2SO4 to form isethionic acid. Pyrosulfuric acid adds, like other inorganic acid anhydrides, to ethylene by fission between the anhydride oxygen and sulfur to form ethionic acid. Carbyl sulfate is formed in ethylene-fuming sulfuric acid reactions by the addition of the alkene to the S2O6 component of the balanced anhydride system SO3 in equilibrium with S2SO6. Further experiments showed that the product of reactions between isethionic acid and one mole of 100% sulfuric acid, one mole of 100% sulfuric acid and one mole of anhydride, or one mole of anhydride alone is ethionic acid. The product of isethionic acid and two moles of anhydride is carbyl sulfate, indicating that isethionic acid is converted to carbyl sulfate by the action of two moles of SO3 or one of S2O6. It is concluded that all sulfonic acid synthesis with sulfuric acid proceed by pseudo-substitution involving the addition of a hydrogen and carbon of a hydrocarbon group in the organic compound to the unsaturated oxygen and the attached sulfur of a sulfonyl group. Sulfonation with sulfuric anhydride is interpreted as an aldolization reaction.

6937 APTIC NUMBER 16049

Mishchenko, Yu. S. and M. L. Chepelevetskii
SOLUBILITY OF AMMONIUM SULFATE IN THE PRESENCE OF SULFURIC AND

PHOSPHORIC ACIDS AND ALSO AMMONIUM PHOSPHATES. Tr. Nauchn. Inst. po Udobr. i Insektofung, no. 208:16-30, 1965. 51 refs. Translated from Russian by Carol C. Parr, Tennessee Valley Authority, 21p., May 10, 1966.
CFSTI: PB 178091-T

The solubility of ammonium sulfate, and also ammonium phosphates, in the presence of sulfuric and phosphoric acids was studied by investigating the 50 deg isotherms of the following ternary systems: (NH4)2SO4-H2SO4-H2O, (NH4)2SO4-H3PO4-H2O, (NH4)2SO4-(NH4)H2PO4-H2, and (NH4)2SO4-(NH4)2HPO4-H2. The region of existence of the salt (NH4)3H(SO4)2 and the binary salt (NH4)H2PO4-(NH4)HSO4 was determined. The presence of the complex salt (NH4)8H2(SO4)5 and its mixed crystals with ammonium sulfate-bisulfate, proposed by a previous investigator, was not detected. Results of the study make it possible to study the four-component system NH3-P2O5-SO3-H2O in a wide range of concentrations. Experimental data are presented in the form of solubility diagrams of the systems studied and in tables of the liquid- and solid-phase composition of the systems.

6938 APTIC NUMBER 16175

Nishchenko, Yu. S. and M. L. Chepelevetskii
SOLUBILITY IN THE SYSTEM (NH4)2HPO4-(NH4)2SO4-H2SO4-H3PO4-H2O. Tr. Nauchn. Inst. po Udobr. i Insektofung, no. 208:30-42, 1965. 14 refs. Translated from Russian by Carol C. Parr, Tennessee Valley Authority, March 15, 1965.
CFSTI: PB 178090-T

All published data on solubility in the system (NH4)2H(PO4)-(NH4)2SO4-H2(SO4)-H3(PO4)-H2O are combined in a common system and are presented in the form of diagrams. The 25 deg isotherm of the system was obtained by recalculating all data in moles of the system's components per 100 moles of anhydrous residue and plotting ischydrate patterns in all crystallization fluids except (NH4)2SO4. The crystallization field of monoammonium phosphate is delineated by a singular angle. The same singular angle presumably delineates the crystallization field of diammonium phosphate. Also presented are the results of investigations of the lines of common crystallization of (NH4)2SO4 + (NH4)3H(SO4)2; (NH4)2SO4 + (NH4)H2(PO4)-(NH4)H(SO4); (NH4)H2(PO4); (NH4)2SO4 + (NH4)2H(PO4); (NH4)3H(SO4)2 + (NH4)H(SO4); (NH4)3H(SO4)2 + (NH4)H2(PO4)-(NH4)H(SO4); (NH4)H2(PO4) + (NH4)2H(PO4); and (NH4)H2(PO4) + (NH4)H2(PO4)-(NH4)H(SO4). The solubility diagram of the 50 deg isotherm of the system is also constructed. The composition of the liquid and solid phases of monoammonium phosphate, ammonium bisulfate, and ammonium sulfate-bisulfate is given in tables.

6939 APTIC NUMBER 15792

Miyake, Yoshihiro, J. L. Gaylor, and H. S. Mason
PROPERTIES OF A SUBMICROSOMAL PARTICLE CONTAINING P-450 AND FLAVOPROTEIN. J. Biol. Chem., 243(21):5788-5797, Nov. 10, 1968. 49 refs.

A procedure is described for isolating submicrosomal particles from the livers of rabbits treated with phenobarbital, without the use of proteolytic or lipolytic enzymes. The preparation contains 2.5 millimicron moles of P-450 per mg of protein, whereas the content of P-420 and cytochrome b5 is less than 1% of this. The preparation shows no distinct TPNH- or DPNH-cytochrome c reductase activity, but DPNH-ferricyanide reductase activity remains. P-450 in the preparation is not reduced by TPNH or by DPNH in the presence of anaerobic CO, even on addition of TPNH-cytochrome c reductase, but it is reduced by the adrenodoxin reductase system in bovine adrenal mitochondria. The physical properties of P-450 in the cytochrome b5 free preparation confirm that P-450 is a low spin protoheme protein in its oxidized state and indicate that it is a high spin ferroheme in its reduced state. The microsomal Fe(x) signal is shown to be the electron spin resonance manifestation of oxidized P-450. (Author summary modified)

6940 APTIC NUMBER 16042

Morris, M. E.
ACOUSTIC DUSTFEEDER. Sandia Corp., Albuquerque, N. Mex., Planetary Quarantine Dept., NASA Contract W-12853, SC-DC-69 1834, 16p., 1969. 3 refs.
CFSTI: PB 184308

To study the deposition of particles from an airstream, a device was constructed to generate a continuous aerosol from a particle bed. The device generates an aerosol by passing a stream of clean air through a bed of particles that are fluidized by audio frequency oscillations of a membrane below the particles. Particles to be dispersed are suspended on a Teflon film stretched over a plastic tube. Only a slight velocity gradient produced at the top of the plastic tube is needed to break up aggregates in the air stream. The technique appears to be a satisfactory method for generating a constant and continuous supply of aerosol composed of particles in the 5-25 micron diameter range. The output of the dustfeeder does not decay rapidly with time. (Author abstract modified)

6941 APTIC NUMBER 15851

Morton, Frank, P. J. King, and A. McLaughlin
HELICAL-COIL DISTILLATION COLUMNS. PART I: EFFICIENCY STUDIES. PART II: LIQUID FILM RESISTANCE. Trans. Inst. Chem. Engrs. (London), 42(8):T285-T304, 1964. 33 refs.

The operation of helical-coil distillation columns was studied at atmospheric and reduced pressures. A correlation is given for efficiency at atmospheric pressure based on the gas film. The importance of liquid-film resistance is stressed for low pressures; its effect is correlated by an extension of the Higbie equation to flow in helical coils. Operation of the 1.1 cm diameter column at partial reflux under an absolute pressure of 20 mm Hg is discussed. Performances of a number of high-efficiency distillation columns are compared. It is shown that the helical-coil design is particularly useful for low-pressure fractionation of heat-sensitive hydrocarbons and that the efficiency of the column at reduced pressures is not satisfactorily

explained solely in terms of the vapor-phase resistance. At atmospheric pressure the helical-coil column does not offer a reasonable alternative to more efficient packings, though its performance is comparable to that of spinning-band and open-tube columns. The liquid film resistance was measured by a carbon dioxide absorption technique and the liquid film coefficients in helical-coils were found to be in general agreement with values predicted for inclined tubes. However, a reason correlation with the experimental resistance data was obtained only when its overall coefficient was calculated on the basis of substantial wetting of the whole surface of the tube. These results imply that the film coefficient is independent of the size of the tube.

6942 APTIC NUMBER 16375

Moruzzi, J. L. and A. V. Phelps
SURVEY OF NEGATIVE-ION-MOLECULE REACTIONS IN O2, CO2, H2O, CO, AND MIXTURES OF THESE GASES AT HIGH PRESSURES. J. Chem. Phys., 45(12):4617-4627, Dec. 15, 1966. 38 refs.

Negative ions formed in high-pressure drift tubes were analyzed by mass spectrometric techniques for various pressures and various ratios of electric field strength to pressure (E/p). Gases studied include O2, CO2, H2O, and CO plus the mixtures CO2-O2, H2O-O2, and CO-O2. Results were presented in the form of plots of the relative negative ion currents as a function of E/p at fixed pressure or as a function of the partial pressure of an added gas, and as plots of the ratios of negative ion currents as a function of pressure at fixed E/p for the various gases and mixtures. The measurements were interpreted in terms of the following reactions between the negative ions and gas molecules: dissociative attachment, three-body attachment, ionization, collisional detachment, two-body conversion, and three-body conversion. A significant finding was the observation of apparent associative-detachment reactions involving O(-) and either CO or H2. This type of reaction is of interest because of the possibility that O2(-) and O(-) ions present in the atmosphere are destroyed by associative detachment in collisions with atomic oxygen. An attempt is being made to measure the rate coefficients for these reactions.

6943 APTIC NUMBER 16315

Moskalenko, N. I.
SPECTRAL TRANSMISSION FUNCTIONS IN BANDS OF H2O VAPOR, O3, N2O AND THE N2 COMPONENT IN THE ATMOSPHERE. (Funktsii spektral'nogo propuskaniya v polosakh parov H2O, O3, N2O and N2 komponent v atmosfere). Text in Russian. Fiz. Atm. i Okeana (Moscow), 5(11):1179-1190, 1969. 17 refs.

The spectral transmission functions of water vapor, ozone, nitrous oxide, and nitrogen were obtained in the infrared region. The presence of absorption bands of the N2 component was shown in the spectral region 3.85-4.3 micron and parameters are given which permit the calculation of its absorption in the atmosphere.

6944 APTIC NUMBER 16599

Mousseron, Max
ON DIVERS ALICYCLIC COMPOUNDS CONTAINING SULFUR. (Sur divers composes alicycligues sulfures). Text in French. Compt. Rend., vol. 216:812-814, June 16, 1943. 7 refs.

In the course of a study of some S-bearing alicyclic compounds, several series of compounds were examined. A brief description of the method of their preparation, the temperatures of their melting and boiling points, their specific gravity at 25 C, and their index of refraction at 25 C are given. A list of these compounds is as follows: cyclohexylthichydroxy-2 cyclopentane, cyclohexylthichydroxy cyclohexane, cyclohexylthiohydroxy-2 cyclohexane, ethyl ether and ethyl diether of bis-hydroxycyclohexyl sulfide, bis-hydroxy-2 cyclopentyl disulfide, bis-hydroxycyclohexyl, cyclohexylthioamino-2 cyclohexane, bis-amino-2 cyclohexyl disulfide, epithiomethene cyclohexane, thiodicyclohexylmethylol-1, cis-methyl-3 cyclohexylsulfonic acid, trans-methyl-3 cyclohexylsulfonic acid, as well as the K-salts of the latter two.

6945 APTIC NUMBER 16611

Mousseron Max and Robert Granger
RESEARCH ON THE ALICYCLIC SERIES. STUDY OF THE ORGANO-MAGNESIUM COMPOUNDS (6TH REPORT). (Recherches en serie alicyclique. Etude des organo-magnesiens (6e memoire)). Text in French. Bull. Soc. Chim. France, vol. 13:251-6, 1946. 27 refs.

In the course of carbonation of magnesium derivatives of the methyl-chlorocyclohexanes, a small yield was obtained in acid, particularly for compounds of two of the hydrocarbon chains with MgBr. These secondary reactions are essentially intermediate reactions in a series of reactions; they are the consequence of the reducing property of the deoxidation of cylic magnesium derivatives. These reactions, which are quite comparable, are described in a study of the action of organo-magnesium compounds on acids and their salts, halogen derivatives of acids, esters, ketones, and aldehydes, that is, a series of compounds having a carbonyl group. The reduction of sulfinic acids formed in the course of fixation of sulfur dioxide on chlorocyclohexylmagnesium is also studied.

6946 APTIC NUMBER 15259

Moyes, A. J. and C. B. Smith
COMPARATIVE RESULTS FOR THE THERMAL AND ELECTRONIC ACTIVATION OF MIXTURES OF SULPHUR DIOXIDE AND OXYGEN. Chem. Eng. (London), 43(190):163-166, July-Aug. 1965. 7 refs.

Experiments in gas electrolysis are reported. Oxidation of sulfur dioxide to sulfur trioxide was investigated in a nondisruptive electrical discharge cell at atmospheric pressures and below. The experimental results are compared with published data for the catalytic reaction. With thermal reactions the volume of catalyst required to achieve conversion rises rapidly with an

increase in sulfur dioxide concentration in the gases. With electronic activation the increase in reactor volume is less pronounced, and is proportionate to the sulfur dioxide flow rate. The rate of thermal oxidation of sulfur dioxide increases linearly with the oxygen content of the mixture. The sulfur dioxide concentration is critical in discharge reactions. Excess oxygen has no effect on the sulfur trioxide yield. It is suggested that in the discharge, electronic activation of the gas molecules occurs in the gas phase and that the overall reaction rate depends on the difference between two apparently first-order reactions. Although it is shown theoretically that electronic activation may be more efficient than thermal activation, it is unlikely to have industrial potential for exothermic reactions for which a suitable catalyst is commercially available. (Author abstract modified)

6947 APTIC NUMBER 15419

Mueller, Peter
A STUDY OF THE QUESTION OF THE INFLUENCE OF SULFURIC ACID ON THE FLUE GAS DEW POINT TEMPERATURE. (Beitrag zur Frage des Einflusses der Schwefelsaeure auf die Rauchgas-Taupunkttemperatur). Text in German. Chem. Ing. Tech., 31(5):345-351, 1959. 33 refs.

The dew point of a sulfuric acid/water vapor mixture was determined for very low partial pressures. The partial pressure of $H_2SO_4$ was computed according to Abel, who based his derivation on the basic idea that at thermodynamic equilibrium between liquid and vapor, the chemical potentials of each component in all phases must be equal. Since at low partial pressure, $H_2SO_4$ vapor may be treated as an ideal gas, partial pressures are used in the calculation instead of the fugacities. The water vapor partial pressures (which are approximately equal to the total pressure of the system) above the liquid phase were taken from various sources for the selected temperatures and acid concentrations. With the computed $H_2SO_4$ partial pressures and the total pressures taken from the literature, the partial pressure conditions were determined and plotted in a diagram which shows that the $H_2SO_4$ partial pressures never exceed 1%. In conclusion, a numerical example for the dew point determination is given.

6948 APTIC NUMBER 15078

Mulvihill, J. W., W. P. Haynes, S. Katell, and G. B. Taylor
COST ESTIMATES OF PROCESSES FOR SEPARATING MIXTURES OF METHANE AND HYDROGEN. Bureau of Mines, Washington, D. C., RI 6530, 43p., 1964. 42 refs.

Capital and operating costs were estimated for separating methane and hydrogen in gas-separating plants designed to produce 90 million standard cu ft per day of product gas containing a minimum of 90 percent methane. After a preliminary literature review of various separation techniques, three different processes moving-bed adsorption using active carbon, oil absorption, and liquefaction were chosen for the cost estimates. Three different methane feed gas concentrations, 5, 20, and 50 percent were chosen as representative methane concentrations for the separation estimates. Capital and operating costs were lowest for the moving-bed adsorption process in all three cases investigated. Operating costs (1964) declined from $0.24 to $0.06 per 1000 cu ft of product gas, and capital costs declined from $47,490,800 to $7,411,200 as the percentage of methane in the feed gas increased from 5 to 50 percent. (Author abstract modified)

6949 APTIC NUMBER 16086

Murray, J. D.
AN INVESTIGATION OF VARIOUS ASPECTS OF AEROSOL MECHANICS. (TERMINAL REPORT). Preprint, New York Univ., N. Y., Dept. of Mathematics, 4p., 1969. 11 refs.

Previous investigations on fundamental aspects of particle-fluid flow are reviewed. One attempt to put equations governing particle-fluid flow on a firm theoretical basis is represented by a continuum model for both fluid and solid phases. This model resolves the apparent inconsistency between the theory of particle-collision pressure and the theory of bulk viscosity. The major problem in any theoretical study of aerosol filtration is the accurate determination of the actual force on a small particle moving time dependently in a fluid, particularly when near a filter fiber. As demonstrated by curves obtained by one investigator, the Stokes drag theory is incorrect. The theoretical curve for filter efficiency of a single fiber when the fluid is assumed to be inviscid is closer to the experimental one that is the theoretical curve obtained by assuming that the fluid is viscous. An inviscid assumption is unjustified, since, in most filtration experiments, the fluid flow Reynolds number is small and the Stokes flow valid. The problem of a particle in motion near a fiber might be solved by a new pertubation approach now under investigation.

6950 APTIC NUMBER 15885

Nagamori, Meguru and Mitsuo Kameda
THERMODYNAMICS OF PYRRHOTITE AT THE TEMPERATURE RANGE OF 800 TO 1100 C. (Pyrrhotite(FeS1 plus X) no 800 do kara 1100 do C ni okeru netsuryokugakuteki kenkyu). Text in Japanese. Nippon Kinzoku Gakkaishi (J. Japan Inst. Metals), 31(3):248-254, 1967. 13 refs.

To establish the relation between the sulfur activities and the composition of pyrrhotite, equilibrium measurements were carried out with the aid of the gaseous mixture $H_2$-$H_2S$. Equations that relate the gas composition at room temperature to that at high temperature were derived thermodynamically by considering the species of $S_2$ and HS in addition to $H_2$ and $H_2S$. The experimental results permit calculations of the activities of sulfur, iron, and FeS; data regarding the formation of stoichiometric FeS; and the heat and the entropy of the mixing in pyrrhotite. The statistical thermodynamics of imperfect crystals is tentatively applied to the system for interpreting the activity composition relations in pyrrhotite. (Author abstract modified)

6951 APTIC NUMBER 14859

Nagasawa, Makoto
SORPTION OF GASES WITH ACTIVATED BENTONITE. I. SORPTION OF SULFUR DIOXIDE. (Katsusei bentonaito ni yoru kitai no shuchaku (dai 1 ho) nisanka io no shuchaku). Text in Japanese. Denki Kagaku (J. Electrochem. Soc. Japan, Japan. Ed.), vol. 23: 62-66, 1948. 5 refs.

Commercial bentonite was purified, activated either by hydrochloric acid treatment or by heating, and used for sorption of sulfur dioxide. Sorption and desorption equilibria were measured at 40, 25, 0, and -10 C in a pressure range up to 800 mm Hg. The measured result was represented by Freundlich's formula in a certain range. The sorption curve approximately coincided with the desorption curve. The sorption equilibria at constant volume and at constant pressure were represented by an experimentally derived formula. The sorption heat differential at constant volume was also studied.

6952 APTIC NUMBER 14587

Meher, G. M., L. P. Doyle, D. M. Thrasher, and M. P. Plumlee
RADIOGRAPHIC AND HISTOPATHOLOGICAL FINDINGS IN THE BONES OF SWINE DEFICIENT IN MANGANESE. Am. J. Vet. Res., Vol 17, p. 121-128, Jan. 1956. 15 refs.

Radiographic and histological examinations of the bones of the legs of swine fed manganese-deficient diets were conducted to reveal the cause of lameness, distortion of legs, and retardation of growth. Comparative studies were made on litter mate pigs provided an adequate ration of manganese. Shortness of bone length in the forelegs and hindlegs, a thickening of bone in the carpal and tarsal area, and a bowing of the front legs were observed in 60% of the animals. A selective retardation of endochondral osteogenesis in the growth of the radii was also observed. A rarefaction of bone occurred and areas of complete aplasia were noted in the distal diaphysis of the ulna of all deficient animals examined at 110 and 125 days. At 335 days, no rarefied areas were present. These lesions were similar to the localized form of osteitis fibrosa and were characterized by the replacement of cancellous bone with a dense, fibrous, moderately vascular tissue. The lipotropic action of manganese was demonstrated by the excessive obesity of the deficient swine and an increase of fat deposition in the bone.

6953 APTIC NUMBER 14848

Nelson, P. F.
BY-PRODUCTS FROM WOOD PULPING. Proc. Roy. Australian Chem. Inst., 34(2):35-44, Feb. 1967. 4 refs.

The chemical characteristics of the 4 main constituents of wood - cellulose, hemicellulose (non-cellulosic polysaccharides), lignin, and extractives (materials which can be removed from wood with neutral solvents) - are described. Pulping, the separation of the wood fibers for paper-making, can be achieved by mechanical, chemical, or semichemical processes; chemical pulping removes the greatest amount of material from the wood and therefore has the highest by-product potential. Pulping under acidic conditions is usually carried out with solutions of sulfur dioxide combined wholly or partly as the bisulfites or cations, and is usually called sulfite or bisulfite pulping. The solubilization of lignin during sulfite pulping has led to the production of a series of lignosulfonates, used in adhesives, tanning, as dispersants and cement additives, and in oil-well drilling muds; they also provide a potential source of phenolic chemicals, the best known of which is vanillin. Sugars obtained in the acidic pulping process from polysaccharides are used commercially as chemical raw materials; some are fermented to produce alcohol and yeast. Alkaline pulping is normally carried out with sodium hydroxide (soda pulping) or a mixture of sodium hydroxide and sodium sulfide (kraft or sulfate pulping). The technical aspects of kraft pulping have acted to inhibit the development of economically feasible by-products. Degraded lignin products have some use in laminating resins, battery plates, and as rubber additives, but, in general, kraft lignin and alkaline-degraded polysaccharides have found few commercial applications. Turpentine and tall oil are the two most valuable by-products recovered from extractives during alkaline pulping of pine woods. The chemical reactions involved in the production of pulping by-products are fully described, and some of the factors affecting the development of by-products from chemical pulping are discussed.

6954 APTIC NUMBER 13742

Nesterenko, V. B. and B. Ye. Tverkovkin
REACTION KINETICS FOR THE REVERSIBLE SYSTEM N2O4 IN EQUILIBRIUM WITH 2NO2 IN EQUILIBRIUM WITH 2NO PLUS O2 IN A FLOW. (Issledovaniye kinetiki khimicheskikh reaktsiy sistemy N2O4 v ravnovesii s 2NO2 v ravnovesii s 2NO plus O2 v potoke). Text in Russian. Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz. Tekhn. Navuk, no. 2:12-19, 1966. 6 refs.

The reversible reactions N2O4 yields 2NO2 yields 2NO plus O2 are assumed to take place in a moving gas with varying moisture concentration and average flow temperature and to significantly affect flow hydrodynamics. The stationary system of differential equations describing the reaction kinetics of this system is then analyzed to yield more reliable information regarding the space-time changes in concentrations of the mixture components and average flow temperature than is given by classical approaches. The following variables are plotted as functions of channel length: average gas temperature (Tg), degree of dissociation (alpha), partial pressure of mixture components, Tg and alpha for various residence times of the mixture in the channel, Tg and alpha for various pressures in the channel, Tg and alpha for various residence times in the case of cooling, partial pressures of components for various residence times in the case of cooling, Tg and alpha for different starting temperatures (from about 430-770 K). The importance of experimental reaction rate constants, determined under actual dynamic conditions, for the study of reaction kinetics in flows is stressed.

6955 APTIC NUMBER 16006

Neumann, August Wilhelm
EFFECT OF BOUNDARY-SURFACE ENERGIES UPON ADHESION OF POWDERS TO SOLIDS. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):24-29, Nov. 1968. 17 refs.
CFSTI: TT 68-50448/11

The adhesive strength of low-energy solids and the adhesive capacity of teflon and siliconated glass powders was investigated by determing surface tensions and boundary surface tensions. Increasing boundary surface tension decreases both the adhesive strength of the glued plastics and the adhesive capacity of the powders. The influence of electrical charging is also significant. At low boundary surface tensions, the adhesive capacity of the powder in the natural state is substantially larger than in the discharged state. Siliconated glass powder agglomerates on teflon and polyvinyl in a manner suggesting not only the influence of adhesion forces at the extended surfaces of the solids but the interaction between the solids themselves. Results are discussed in terms of the soiling of paint. It is assumed that with increased wetting, the surface tension of paint increases and the boundary surface tension with respect to inorganic dirt particles decreases. As a result, the adhesive capacity, i.e., soiling should increase.

6956 APTIC NUMBER 14666

Neumann, Bernhard
SULFUROUS ACID PRODUCTION FROM GYPSUM. (Gewinnung von schwefliger Saeure aus Gips). Text in German. Z. Angew. Chem. (Weinheim), 39(50):1537-1542, Dec. 16, 1926. 10 refs.

The patented processes for sulfurous acid production from gypsum are briefly outlined. Study of them shows that it has rarely been suggested to decompose gypsum by dissociation. Usually gypsum is decomposed with the aid of additives such as quartz, clay, coal, or iron oxide. Extremely high temperatures are required for dissociation of gypsum into CaO and SO3, even with the aid of additives which help to liberate SO3. The fuel consumption is very high and is the main obstacle to economic sulfurous acid production. Therefore, the use of synthetic or blast furnace slag has been suggested. Experiments were conducted with both types of slag. Synthetic slag contained about 2.9% sulfur, while blast furnace slag had a high sulfur content. It was found that both high- and low-sulfur slags can be used. A rough estimate shows that addition of 1 kg anhydrite to 10 kg slag would reduce the temperature of the slag to 1000 C, causing solidification. Addition of 0.5 kg anhydrite only reduces the temperature to 1200 C, which is considered acceptable. In addition, flue gas should be used for auxiliary heating. The sulfurous acid yield from high-sulfur slag was 90%. In conclusion, Diel's process for utilization of slag sulfur is discussed.

6957 APTIC NUMBER 15429

Neumann, Bernhard and Erich Goebel
THE ADSORPTION OF SULFUROUS ACID ON PLATINUM, IRON OXIDE AND CHROMIUM OXIDE. II. (Die Adsorption von schwefliger Saeure an Platin, Eisenoxyd und chromoxyd. II.). Text in German. Z. Elektrochem., 39(8):672-82, 1933. 24 refs.

Adsorption of SO2 on iron oxide and chromium oxide was studied and the adsorption heats determined. The adsorption on platinum was described in the first part of the paper. The iron oxide used in the experiments was obtained from iron carbonyl. Adsorption was rapid between 20-100 C, but decreased slowly at higher temperatures; it ceased after 12 hours. Isotherms obtained at 400 C were almost straight lines. The development of heat proceeds on similar lines, increasing rapidly in the beginning and then decreasing until no development is observable. The chromium oxide was obtained from Cr(NO3)3.9H2O heated to 250 C in a hydrogen stream. The substance melts in crystal water to a pure chromium oxide. The adsorption on chromium oxide paralleled that on iron oxide. Below 200 C only adsorption occurs. Above 200 C chemical reactions set in. The adsorption heats of both oxides are about 40,000 cal/mole at low temperatures; they decrease with increasing temperature. The decrease is more marked with the iron oxide.

6958 APTIC NUMBER 16466

Neumann, Bernhard and Gustav Heintke
THE CATALYSIS OF SULFURIC ACID ON IRON OXIDE. (Schwefelsaeurekatalyse mit Eisenoxyd). Text in German. Z. Elektrochem., 43(4):246-254, 1937. 17 refs.

It is known that sulfur trioxide formation with iron oxide catalysis is based on an alternating reduction and oxidation of the iron oxide with a change in the valence. The reaction mechanism follows the equation 3Fe2O3 + SO2 yields 2Fe3O4 + SO3 and 2Fe3O4 + O yields 3Fe2O3. The equation, however, gives no information on the intermediate products. The ferrisulfate and the ferrosulfate were thought to be the intermediate products. The partial pressures of SO3 over the contact, however, did not agree with the SO3 pressures developing at the dissociation of the sulfates. To determine whether earlier tension measurements of the sulfates were accurate or whether the two are not the intermediate reaction products, the tensions of ferro and ferrisulfate were measured again. The preparation of a waterfree ferrisulfate by boiling pulverized FeSO4 + 7H2O in concentrated sulfuric acid yielded a ferro-ferrisulfate at the thermal dissociation. This salt Fe3(SO4)4 was also obtained by oxidation of waterfree FeSO4 with air. Tension measurements were also performed with these differently prepared salts. The results of all these measurements showed that the ferro-ferrisulfate is the intermediate product of iron oxide catalysis. The change of valency takes place between Fe2O3 and Fe3O4 and not, as previously assumed, between Fe2O3 and FeO.

6959 APTIC NUMBER 14675

Neumann, Bernhard and Heinrich Kunz
THE REACTION IN THE HARGREAVES PROCESS. (Die Reaktion beim

Hargreaves-Prozess). Text in German. Z. Angew. Chem. (Weinheim), 42(47):1085-1087, Nov. 23, 1929. 5 refs.

The reaction of the Hargreaves process (2NaCl plus SO2 plus H2O plus O yields Na2SO4 plus 2Hcl) was studied in the absence of oxygen. First the equilibrium constant was determined with Nernst's formula and it was found that very little HCl is formed. Next, experiments were conducted in a glass pipette ending in a capillary tube and containing a 10 cm-long layer of NaCl and platinum asbestos over which measured amounts of a mixture of water vapor and sulfurous acid were passed at temperatures from 350 to 600 C. The quantity of SO2 was varied and a slow gas velocity of 0.05 mole SO2/hr was selected. Generally, HCl increased with temperature at constant SO2 quantity. Comparison of the experimental results with the theoretical results showed a largely similar increase of the equilibrium constants with rising temperature, but the HCl measured was a hundred times larger than the quantity theoretically predicted. Further experiments yielded an explanation: in the reaction of SO2 and H2O with NaCl, sodium sulfite is formed at 500 C. If no oxygen is present, the sulfite is decomposed again. Sodium sulfate develops and sulfur is precipitated in an autooxidation-reduction reaction. In the presence of oxygen, the sulfite is oxidized to the sulfate without sulfur precipitation.

6960 APTIC NUMBER 15742

Nevins, J. W.
FINNED TUBE EXCHANGERS SOLVE WIDE VARIETY OF HEAT TRANSFER PROBLEMS. Power, 109(7):62-65, July 1965.

By extending the surface of heat exchanger tubes with fins, the total amount of heat transferred can be increased and the size of the heat-exchange equipment reduced. Among available fins, longitudinal fins are the most readily adapted to a wide range of operation conditions, types of fluids, and temperature requirements. As with other fins, their use depends on temperature and time demands, heat loss, allowable pressure drop, velocity limitations, and fluid properties such as density, viscosity, specific heat, and thermal conductivity. Because longitudinal fins are permanently bonded to the parent tube, fluid contaminants cannot lodge in the fin channel. For most fluids and at temperatures to 650 F, carbon steel is an economical material for fins. For higher temperatures or corrosive flows, more corrosion-resistant alloys should be considered. Properties of commonly used alloys are listed. In addition to giving high rates of heat transfer in tank heaters, longitudinal fins are ideal for separating condensible vapors from gases in gas coolers.

6961 APTIC NUMBER 15058

Nezlin, M. V. and P. M. Morozov
INFLUENCE OF ELECTRIC FIELDS IN ION BEAMS ON ELECTROMAGNETIC SEPARATION OF STABLE ISOTOPES. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:450-454. 1 ref. (Translated from Russian).

Experiments using lithium, calcium, cadmium, zinc, tellurium, and tin as charge materials were carried out to investigate the process of compensation of an intensive ion beam space charge in electromagnetic isotope separation. Experimental methods and apparatus are described, including the simultaneous measurement of the ion beam potential in the region of each cell and observations of the distribution of the ion current density in the beam. It is concluded that, for all the elements studied, when the current strength in the ion beam increases, the degree of decompensation of the ion beam space charge rises sharply, thus severly limiting the productivity of the separating unit. By increasing the cathode ion current, however, it was found possible to double the unit's productivity. Other causes for disturbance of the ion beam compensation were found and other methods developed for improving the compensation of ion beams and for effectively separating the isotopes of various elements at the maximum strength of the current in the ion beam which the source permits. The same method of increasing the cathode ion current was used to eliminate the potential minimum near the cathode, and thus control an oscillation mechanism in the discharge. It was found that the results depended greatly on the geometry of the discharge box, and that by following the method described for measuring the potential distribution in the ion beam, a rapid and clear choice of an optimum geometry was possible.

6962 APTIC NUMBER 16043

Nichipor, G. V.
KINETICS OF THE RADIATION-THERMAL DECOMPOSITION OF NO2 IN FLOW. Vestsi Akad. Navuk Belarusk. SSR: Ser. Fiz, Tekhn. Navuk, no. 4:29-34, 1967. 19 refs. Translated from Russian by Stephen J. Amoretty, Brookhaven National Lab., Upton, N. Y., Information Div. BNL TR 223, 10p., Sept. 1968.

An attempt is made to describe the kinetics of the radiation-thermal decomposition of nitrogen dioxide in one-dimensional flow. Formulas are given for 14 chemical reactions, produced by the action of heat and ionizing radiation, that govern one-dimensional flow. The distribution of mixture components in one-dimensional flow is described by a set of eight first-order differential equations with nonlinear right-hand terms. It is shown that at temperatures greater than or less than 500 K, the effect of radiation effects on the space-time distribution of mixtures can be neglected only at the very beginning of the chemical stage constituting the processes leading to the establishment of chemical equilibrium. Specific rates of 12 of the 14 chemical reactions are tabulated, and the ratio of the rates of the initial radiation and thermal decomposition of NO2 is plotted as a function of temperature at a dose output of 1 times 10 to the 16th power ev/cu cm/sec.

6963 APTIC NUMBER 14356

Nikitin, V. A. and T. I. Kunin
REDUCTION OF SODIUM SULFATE BY GASEOUS REAGENTS. (Vosstanovleniye sul'fata natriya razoobraznymi reagentami). Text in Russian.

Izv. Vysshikh Uchebn. Zavednii Khim i Khim. Tekhnol., 6(2):263-267, 1963. 32 refs.

The reducing properties of petroleum gas, propane-butane fraction from petroleum refining, and semiwater producer gas in relation to production of sodium sulfide from sodium sulfate were studied and compared with those of hydrogen. Petroleum gas was found to be the most active, yielding a highly-concentrated product and eliminating the leaching stage and evaporation of sodium sulfide solutions. Activities of catalysts investigated rank in the following descending order for the case of petroleum gas: Fe2O3, Fe2(SO4)3, NiSO4, sawdust, and NaCO2H (negative effect). Iron(III) oxide may be used in the form of pyrite cinders, a by-product of the sulfuric acid industry. Conducting the reduction process at high flow rates for the reducing gases leads to increased soda content and scorification of the sodium sulfate.

6964 APTIC NUMBER 15491

Novak, J. R. and M. W. Windsor
LASER PHOTOLYSIS AND SPECTROSCOPY IN THE NANOSECOND TIME RANGE: EXCITED SINGLET STATE ABSORPTION IN CORONENE. J. Chem. Phys., 47(8):3075-3076, Oct. 15, 1967. 5 refs.

Laser photolysis apparatus with a spectroscopic source, capable of recording the spectral absorption of transient species in the nanosecond time range, was developed and used to study the first excited singlet state of coronene. Coronene showed a laser line at 347 nm and fluorescence between 410 and 480 nm. Ground state absorption bands of coronene were in the 320-350 nm region. Using both excitation and background pulses, the middle exposure showed heavy bleaching of the ground-state absorption bands and a new absorption in the 500 nm region with a peak at 520 nm. The 520 nm band decayed at the same rate as the fluorescence and was concomitantly replaced by triplet bands growing in at 480 and 390 nm. This was considered unequivocal confirmation that absorption by the S 1 state is responsible for the 520 nm band. This technique is faster by about two orders of magnitude than current flash-spectrographic instrumentation and extends the studies of transient absorption spectra into the nanosecond range. By using calibrated plates or photoelectric recording, kinetic data can be obtained. This technique should have wide application to solid, liquid, and gaseous systems in searching for intermediates of very short life and increasing the understanding of photochemical primary processes.

6965 APTIC NUMBER 15180

Noyes, Richard M.
REACTIONS OF DIATOMIC MOLECULES. I. A METHOD FOR PREDICTING MECHANISMS. J. Am. Chem. Soc., 88(19):4311-4318, Oct. 5, 1966. 17 refs.

If a system contains only diatomic molecules and their dissociation products, any appreciable net chemical reaction will almost certainly proceed either by a bimolecular mechanism or by an atomic chain. Factors influencing the relative rates by these two mechanisms were analyzed. Entropy terms can be estimated with modest confidence. If bond energies are known, activation energies for chain-propagating steps can be estimated with uncertainties that probably do not exceed 3 kcal/mole. A method was developed to estimate the activation energy for the four-center bimolecular mechanism if bond distances, bond energies, and bond force constants are known for the reactant and product molecules. One disposable parameter is used to get agreement with the known value for hydrogen iodide synthesis. For transition states containing four atoms of the same element, the ratio of predicted activation energy to bond dissociation energy is four times as great for hydrogen (known to exchange by the atomic chain mechanism) as for iodine (predicted to exchange by the bimolecular mechanism). The results of these empirical calculations agree with the qualitative prediction that increased polarizability of electron clouds should favor bimolecular mechanisms. (Author abstract modified)

6966 APTIC NUMBER 15181

Noyes, Richard M.
REACTIONS OF DIATOMIC MOLECULES. II. PREDICTIONS AND COMPARISONS WITH EXPERIMENT. J. Am. Chem. Soc., 88(19):4318-4324, Oct. 5, 1966. 13 refs.

The rates and mechanisms for 110 possible reactions of diatomic molecules, 47 of which involve net chemical change, were estimated from a previously developed method. Twenty of these reactions appeared to have mechanistic significance. In all but one or two of the 20 reactions, kinetic and mechanistic predictions were in agreement with experiment or discrepancies could be rationalized. The following mechanistic predictions are made. Isotopic scrambling for the elements H, Li, Na, K, and probably N and O, will proceed by atomic chain mechanisms under experimentally attainable conditions. Isotopic scrambling of the elements F, Cl, Br, and I will proceed by bimolecular mechanisms. Iodine is the only halogen that will react with hydrogen preferentially by a bimolecular mechanism, but it may be possible to detect a contribution from this mechanism in the bromine reaction. All halogen-halogen reactions will proceed by bimolecular mechanisms. The two mechanistic types are of comparable probabilities for reactions of halogens with hydrogen halides. Symmetrical (exchange) reactions of hydrogen halides with hydrogen and with other hydrogen halides will proceed by atomic chain mechanisms. Chlorine molecules will react with sodium molecules with an activation energy almost as low as that for the reaction with sodium atoms. Nitric oxide will decompose by a bimolecular mechanism, forming N2 + O2 (or perhaps N2O + O), although an atomic chain mechanism will become dominant at very high temperatures. Mechanisms involving metastable triatomic molecules complicate predictions for other reactions involving carbon, nitrogen, and oxygen. (Author abstract modified)

6967 APTIC NUMBER 15835

O'Brien, M. G. and B. L. Turner
PIN THERMAL EFFICIENCY DURING SIMULTANEOUS HEAT AND MASS

TRANSFER. Am. Inst. Chem. Engrs. J., 11(3):546-548, May 1965. 5 refs.

Problems of determining the proper fin efficiencies for sensible heat transfer and mass transfer are discussed. In the case of sensible heat transfer only, the amount of heat transferred to the entire fin is computed by using the temperature of the gas, the temperature of the bare tube surface, and a fin efficiency to correct the temperature driving force used to the true average temperature driving force. In the case of simultaneous heat and mass transfer due to condensation, the heat flux at points between the tip of the fin and its base will be different than the heat flux in the case of sensible heat transfer only. As a result, the fin efficiencies derived for sensible heat transfer only will not be correct for the simultaneous heat and mass transfer. In the numerical example studied, the sensible heat transfer efficiency approached a maximum value when the fraction of the total heat transferred as latent heat approached zero. In the case where the fin end temperature approached the dew point of the gas, the condensation efficiency approached zero, while at the same time, the sensible heat transfer efficiency approached its maximum value. It is concluded that the rates of heat and mass transfer to fins must be evaluated by use of individual fin efficiencies to obtain their proper values.

6968 APTIC NUMBER 15041

Ockendon, J. R.
THE UNSTEADY MOTION OF A SMALL SPHERE IN A VISCOUS LIQUID. Michigan Univ., Ann Arbor, Engineering Mechanics Dept., Grant AP 00455-01, TR 2, 16p., May 1967. 5 refs.

The drag experienced by a sphere moving with arbitrary velocity in an unbounded viscous fluid is derived assuming the Reynolds number is small. The result is compared with the drag predicted by the unsteady Stokes equations, which becomes invalid for large times because the nonlinear terms in the fluid acceleration are neglected. The effect of the nonlinear terms is to modify the drag by a term whose importance for large times is demonstrated for the case when the sphere moves impulsively. The derived formula has particular applications for studies of aerosol motion. It can be used in calculating the relaxation time taken for a sphere subjected to a constant force to attain a constant velocity. (Author abstract modified)

6969 APTIC NUMBER 14464

Ohigashi, Shunichi, Yoshisuke Hamamoto, and Seiichi Tanabe
A NEW DIGITAL METHOD FOR MEASURING GAS FLOW VELOCITY BY ELECTRIC DISCHARGE. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 6 refs. (Presented at the International Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690180.)

A new measuring technique of gas stream velocity was developed based on the phenomen that the path of an electric discharge moves downstream under the influence of the gas stream. A probe (a thin conductive wire grounded by a resistance) is placed at a fixed distance (l) downstream from the electrodes. When the discharge path arrives at the probe, the probe voltage rises rapidly. By measuring the time interval (tau) elapsing between the beginning of the spark and the rising of probe voltage, the stream velocity (U) can be determined by the formula U equals Kl/tau, where K is a constant. As the result of preliminary tests, it was confirmed that K is independent of distance, intensity of turbulence, temperature, and pressure of flowing gases, and depends only on the electrode spacing. The digital measurement of the time interval can be made easily. This technique can be applied not only to a steady flow but also to a pulsating flow such as that in the inlet and exhaust pipe or the air flow in the cylinder of the internal combustion engine. The details of the measuring technique and some results obtained by applying this technique to the inlet flow, exhaust flow, and air flow in the cylinder of two-stroke cycle spark-ignition engines are described. (Author abstract modified)

6970 APTIC NUMBER 15137

Oliveri, E.
SEPARATION EFFICIENCY IN THE PROCESSES OF ISOTOPES ENRICHMENT BY DIFFUSION. (L'efficienza della separazione nei processi di arricchimento isotopico per diffusione). Text in Italian. Energia Nucl. (Milan), 8(7):474-482, July 1961. 9 refs.

Discussion of the principle by which two mixed gases are partially separated due to their unequal diffusion rates is simplified by examining the diffusion of two gases through an aperture in a thin wall, permitting derivation of a formula for the 'separation factor' in terms of the molecular masses of the two gases. With diffusion through a porous solid, the only situation of practical importance here is when the mean free path of the molecule and the mean radius of the pores are of similar size. De Bethune and Present assume the additivity of molecular counts for viscous and nonviscous flow, the former being expressed by Poiseuille's law in terms of pressure and viscosity of the gas mixture. The nonviscous member of the sum must reckon with 'momentum transfer'. Using a formula of G. J. Hinch, one can calculate the pressure at which separation of the gases by diffusion will be most efficient. The 'enrichment factor' is, practically speaking, independent of the concentrations of gases diffused. A turbulent motion on the side of the diffusion cell from which the gases are being absorbed will give better results. The lowering of the temperature at which diffusion takes place has the general effect of lowering the enrichment factor.

6971 APTIC NUMBER 15027

Oliveri, E.
SQUARING CRITERIA FOR A DIFFUSION CASCADE. Energia Nucl. (Milan), 8(7):453-459, July 1961. 4 refs.

When a gas comprising two types of isotopic molecules diffuses through a porous membrane into a space where the vacuum is

fairly high, the lighter molecules diffuse more rapidly than the heavier ones. After a simple diffusion process, the increase in concentration of the light isotope is very small. A before-and-after comparison of the two concentrations is made by the separation factor r. If a significant separation of the two components requires that the diffusion process be repeated, for instance, a thousand times, this could be achieved efficiently in an ideal cascade, where the fraction of the feed molar flow rate diffusing through the membrane equals one-half for r - 1 less than 1, and where the material flow rates vary from stage to stage. For practical reasons an ideal cascade is ordinarily squared-off, resulting in a set of square section, or 'steps.' A direct calculation method is presented for squaring off a cascade of 900 stages in six short steps. By giving the minimum gas flow rate in the entire cascade plant, the equation permits the optimum dimensions of each generic step to be determined.

6972 APTIC NUMBER 15960

Ostergaard, K. and P. I. Theisen
THE EFFECT OF PARTICLE SIZE AND BED HEIGHT ON THE EXPANSION OF MIXED PHASE (GAS-LIQUID) FLUIDIZED BEDS. Chem. Eng. Sci., 21(5):413-417, 1966. 7 refs.

The effects of gas and liquid velocity and particle size and bed height on fluidized bed expansion were studied in experiments in which particles were supported by wire screens in Pyrex glass columns. Liquid was introduced through the wire screens and atmospheric air, through copper tubes. Bed expansion was measured for fluidized glass ballotini. Particle diameters varied from 0.28 to 2.2 mm and settled bed heights, from 14-107 cm. The characteristic reduction of the porosity of liquid fluidized beds on injection of a swarm of gas bubbles was observed for all particle sizes, but was most marked in beds of small particles. The reduced porosity is related to reduced liquid velocity in the bed's liquid fluidized phase. Porosity reduction was greatest in the 0.28 ballotini beds that had a high ratio between bed height and diameter. This effect might be caused by bubble coalescence and increased wake velocity. In some cases, injections of gas in beds of 1.2 mm ballotini increased bed porosity, suggesting that porosity measured at zero gas velocities does not correspond to equilibrium bed expansion at the respective zero velocities. Improved understanding of the mechanics of gas-liquid fluidized beds awaits individual measurements of fractional gas and liquid hold-ups in fluidized beds.

6973 APTIC NUMBER 16609

Overberger, C. G. and J. A. Moore
COPOLYMERISATION OF BENZYL VINYL SULPHIDE WITH SULPHUR DIOXIDE. Chem. Ind. (London), no. 1:24, Jan. 6, 1968. 10 refs.

During studies of the oxidation of polyfunctional mercaptans, a sulfur-containing monomer which could be readily homopolymerized and subsequently converted to poly(vinyl mercaptan) was sought. Benzyl vinyl sulfide (BVS) was investigated. When BVS was injected in liquid sulfur dioxide at -20 to -30 deg in the presence of dry air, a bright, yellow color was formed immediately and persisted until the end of the reaction. Evaporation of unreacted sulfur dioxide at atmospheric pressure and room temperature yielded a thick, yellow mass which dissolved in chloroform to give a yellow solution. The yellow color disappeared and a white solid was precipitated upon addition of this solution to methanol. The dried product was found to be a 1:1 copolymer of SO2 and BVS, and not a homopolymer of BVS as previously reported. When the experiment was performed in the absence of air, no yellow color was formed and only traces were obtained of a solid, which was not a 1:1 copolymer. The yellow color observed when the reaction was carried out in air may be indicative of the intermediacy of a charge transfer complex in the reaction.

6974 APTIC NUMBER 15456

P'yankov, V. A.
ABSORPTION OF HYDROGEN SULFIDE AND SULFUR DIOXIDE IN A FLOW OF AIR. (O pogloshchenii serovodoroda i sernistogo gaza v toke vozdukha). Text in Russian. Zh. Obshch. Khim., 5(8):1112-1118, 1935. 2 refs.

The absorption of hydrogen sulfide and sulfur dioxide by activated carbon was studied at the Institute of Labor Hygiene and Pathology. Methods were established for H2S and SO2 analysis in a rapid air flow by absorption in an alkaline solution with subsequent titration of sulfite and sulfate with iodine in acetic acid. Replacing pure carbon by iodinated carbon resulted in a several-fold increase in H2S adsorption and also, to a much less extent, an increase in SO2 absorption. The ratio between H2S absorption rates between iodinated and pure carbon increases with temperature. Sulfur dioxide absorption rate increases in general with increased temperature, the ratio between iodinated and pure carbon remaining about the same.

6975 APTIC NUMBER 16094

Palin, D. E. and H. M. Powell
THE STRUCTURE OF MOLECULAR COMPOUNDS. PART III. CRYSTAL STRUCTURE OF ADDITION COMPLEXES OF QUINOL WITH CERTAIN VOLATILE COMPOUNDS. J. Chem. Soc., 1947:208-221, 1947. 15 refs.

The crystal structure of quinol with a series of complexes with certain volatile compounds of the general type 3C6H4(OH)2M, where M denotes the second molecules was studied. The second molecules included H2S, HCO2H, HCN HCl, HBr, CH3OH, and CH3Cl. There was also a detailed determination of the structure of the complex with sulfur dioxide. It was shown by three-dimensional Fourier methods that quinol molecules link together through hydrogen bonds to form infinite three-dimensional complexes of trigonal symmetry. The resulting giant molecule has a form, imposed by the dimensions of the quinol molecules and the disposition of the hydrogens bonds, so open that two such giant molecules are built up completely interpenetrating each other but having no direct attachment. In cavities enclosed simultaneously by the two giant molecules, the molecules of the second volatile component

are located so that they cannot escape from its surroundings. The composition, 3C6H4(OH)2M, was determined by the number of spaces available for the second molecule M. In the case where M is sulfur dioxide, the coordinates of all atoms of the quinol framework were found. The position of the sulfur dioxide and its rotation about one axis were also established by Fourier analysis. In the quinol molecule, the interionic distance found were C-C, 1.39 A; C-O, 1.36 A; and OH...O, 2.75 A. The hydroxyl groups were arranged in hydrogen bonded hexagons. The analysis involved some special applications of Patterson methods which were used to establish the presence of a symmetry center and to locate most of the atoms in a direct manner. (Author abstract modified)

6976 APTIC NUMBER 15847

Parkes, Deric William and Richard Bromley Evans
IMPROVEMENTS RELATING TO THE REMOVAL AND RECOVERY OF ACIDIC GASES. (Robinson Bros. Ltd., Oldbury, England) British Pat.868,972. 5p., July 16, 1937. (Appl. Jan.14, 1937, 8 claims).

A process for the removal and recovery of carbon dioxide from acidic gases was invented. The process is cyclic and provides for alternate absorption by dipiperidyls and liberation of carbon dioxide. The acidic gas mixture is brought into contact with an aqueous solution of the dipiperidyls of their homologues in the presence of water. The compound that is formed by the reaction is decomposed by heating; water is added to prevent charring. This regenerates the absorbent and liberates the carbon dioxide. The dipiperidyls and their homologues are derived from the electrolytic reduction of technical pyridine bases in an acid solution and are air-blown at a slightly elevated temperature and then redistilled prior to use. This method may be used to recover CO2 in the production of liquid and solid carbon dioxide to remove in certain hydrogenation processes where the hydrogen is recirculated, to remove it from coal-gas, and to rapidly remove it from the atmosphere in enclosed spaces where oxygen is being used.

6977 APTIC NUMBER 15968

Paul, Ram Chand and M. S. Bains
COORDINATION CHEMISTRY OF SULPHUR TRIOXIDE WITH OXYGEN BASES. In: Proc. Intern. Conf. Coordination Chem., 8th, Vienna, 1964. V. Gutmann (ed.), Vienna, Commission Springer-Verlag, p. 366-369. 3 refs.

The formation of definite compounds of sulfur trioxide with alcohols, ethers, esters, and fatty acids was established by potentiometric, conductometric, and visual titrations and by viscosity, density, dipole moment, and molecular weight determinations. The conductivity-composition curve of sulfur trioxide-alcohol systems shows a maximum at 1:4-5 molar ratio, indicating that the adducts formed are highly solvated. There are breaks at 1:1 and 1:2 ratios but none at a 1:3 molar ratio. Sulfur trioxide solutions in alcohols act as monobasic acids against nitrogen bases: the stable species in alcohol solutions are tetracoordinated alkyl hydrogen sulfates which are monobasic ionizable acids. In sulfur trioxide-ester systems, 1:2 and 1:1 compounds are indicated. With higher esters there is a break only at 1:1 molar ratio. The behavior of sulfur trioxide with ethers is analogous. With acetic acid there is a first maximum at a 1:5 molar ratio, a break at 1:2 stoichiometry, but none at a 1:3 ratio. With all other acids there are breaks at both the 1:3 and 1:2 ratios. The average decrease in molar volume for mono adducts of esters and di-adducts of acids with sulfur trioxide is 18.5 cc and 21.0 cc, respectively. The decrease is probably due to substitution at the sulfur oxygen double bond. The molecular species produced in solution are highly dipolar. An octahedral configuration is proposed for propionic acid tri-adducts of acetic acid-sulfur trioxide systems.

6978 APTIC NUMBER 14465

Pechkovskiy, V. V. and A. L. Sofronov
CHLORINATION OF CALCIUM SULFATE IN A MEDIUM OF FUSED CHLORIDES. (Khlorirovaniye sul'fata kal'tsiya v srede rasplavlennykh khloridov). Text in Russian. Zh. Prikl. Khim., 40(12):2711-2716, 1967. 7 refs.

It was found that the chlorination of calcium sulfate in the presence of a reducing agent in a medium of fused calcium and potassium chlorides takes place with sufficient speed at temperatures above 800 C. Only calcium sulfate which has dissolved in the melt is subject to chlorination; hence, the CaSO4 charge is selected so as to assure saturation of the melt with dissolved reagent. Increasing the reaction temperature to 800-950 C results in an increase in reaction rate, together with an increase in the solubility of CaSO4 in the melt. The process rate depends significantly upon the wettability of the reducing agent by the melt. The mechanism of the process changes with the nature of the melt; in a CaCl2 melt, chlorination leads predominantly to the formation of SO2 and CaCl2; in a KCl melt it leads to elemental sulfur.

6979 APTIC NUMBER 16380

Pechkovskiy, V. V. and A. N. Ketov
INVESTIGATION OF THE REDUCTION OF BARIUM SULFATE BY CARBON MONOXIDE AT HIGH TEMPERATURES. (Issledovaniye vosstanovleniya sul'fata bariya okis'yu ugleroda pri vysokikh temperaturakh). Text in Russian. Zh. Prikl. Khim., 33(8):1719-1723, 1960. 8 refs.

In a detailed study of the process of reduction of BaSO4 to BaS by CO, the authors annealed in a porcelain boat placed in a tubular electric furnace at several different temperatures for 5 minutes each 0.5 gram samples of chemically pure BaSO4 or of BaSO3, contaminated by 2.55% BaCO3 and 0.12% BaSO4, in a stream of purified CO, as well as chemically pure BaO in a stream of Ar, contaminated by 0.06% O2, mixed with S vapor to maintain the stoichiometric S/BaO ratio during the experiment. All samples were allowed to cool in their respective gas streams in a cool section of the furnace. All reaction products were chemically analyzed. In particular, S was determined in the form of SO2 and COS in the gas phase and in that of BaSO4, BaSO3, BaS, and BaS2O3 in the solid phase. In addition, the solid-gas systems

BaSO4-CO, BaSO3-CO and BaSO3-Ar were investigated thermographically by heating for 55 min from 0 to 1100 C. The results are given in three tables and three thermograms and discussed in detail. They show that the reduction of BaSO4 by CO involves the following reactions: BaSO4 + CC equals BaSO3 + CO2; BaSO3 equals BaO + SO2; 2(SO2) + 4(CO) equals 4(CO2) + S2; 4(BaO) + 3(S2) equals 4(BaS) + 2(CO2), in which the gas phase plays an essential role. The first of these reactions occurs at 772 C and the second, which is a therral dissociation, at 588 C.

6980 APTIC NUMBER 14618

Pechkovskiy, V. V.
REACTION OF SULFUR DIOXIDE WITH METAL OXIDES IN AN OXIDIZING ATMOSPHERE. (Vzaimodeystviye sernistogo gaza s okislami metallov v okislitel'noy atmosfere). Text in Russian. Zh. Prikl. Khim., 30(11):1580-1583, 1957. 7 refs.

The degree of conversion of metal oxides to their corresponding sulfates by SO2 as a function of temperature (400-1000 C), duration of reaction (5-60 min), physicochemical properties of the sulfatized mixture and of the resultant products, and SO2 concentration (2.5-20 vol %) was studied experimentally. The following sequence of increasing activity was established: ZnO, MgO, CaO, and, above 600 C, Fe2O3, CuO, Co2O3, Mn2O3. The following sequence of increasing activity was established for catalytic additives in the sulfatization of MgO: CuO, Fe2O3, Cr2O3. The catalyzed reaction of MgO was found to be very intense with as little as 2.5% SO2 in the gas mixture.

6981 APTIC NUMBER 15447

Pechkovskiy, V. V. and T. G. Mal'tseva
REACTION OF CALCIUM OXIDE WITH SULFUR DIOXIDE UNDER REDUCING CONDITIONS. (O vzaimodeystvii okisi kal'tsiya s sernistym gazom v vosstanovitel'nykh usloviyakh). Text in Russian. Zh. Prikl. Khim., 37(2):240-246, 1962. 18 refs.

Thermodynamic analysis of the reaction of calcium oxide with sulfur dioxide under reducing conditions is made from the literature data for reaction temperatures ranging from 310 to 1100 C. It is concluded that at low temperatures, formation of calcium sulfate proceeds through a sulfite ion stage, while the formation of calcium sulfide proceeds basically through direct reaction of calcium oxide and sulfur produced by reduction of SO2. Hence the formation of calcium sulfide is limited by the reaction rate of SO2 reduction by various reducing agents. At high temperatures, the formation of calcium sulfide is determined by the rate of reduction of calcium sulfate by various types of reducing agents. On the basis of thermographic analysis, it is determined that CaO reacts with elemental sulfur at 455 C.

6982 APTIC NUMBER 13875

Pechkovskiy, V. V.
THERMOCHEMICAL DISSOCIATION OF MAGNESIUM SULFATE. (O termokhimicheskom razlozhenii sul'fata magniya). Text in Russian. Zh. Prikl. Khim., 29(8):1137-1142, 1956. 5 refs.

The rate of thermochemical dissociation of magnesium sulfate as affected by temperature, time, oxygen content of the gas passing over the sulfate, and the presence of various metal oxides was studied experimentally to determine the usefulness of this material as a source for producing acid. Practical dissociation occurred at 950-1100 C. Of the additives tested (SiO2, Fe2O3, CuO), ferric oxide and cupric oxide were found to have a very significant accelerating influence on the dissociation reaction, this influence being always greatest in the absence of oxygen (under nitrogen). The data presented will be helpful in determining additives to be selected for use with this process.

6983 APTIC NUMBER 14864

Peleg, Mordechai
VOLTAMMETRIC DETERMINATION OF WATER IN MOLTEN ALKALI NITRATES. J. Phys. Chem., 71(13):4553-4556, Dec. 1967. 12 refs.

The solubility of water in melts of alkali metal nitrates was determined by following the water wave using a rotating solid microelectrode voltammetric technique. The experimental setup allowed the salt to be subjected to evacuation at pressures down to 50 torr. The solubility was observed to follow Henry's law in the range of pressures studied. Good agreement for LiNO3 was evident with results from other methods and therefore validated the method and calibration technique for that salt. Comparison of the solubility of water in molten lithium nitrate with that for molten lithium chloride indicated that the solubility of the water is due to the lithium ion. It appeared that any water present in a lithium ion melt must be bound to the lithium ion. The relatively high solubility of water in molten nitrates and chlorides as compared to various gases in similar melts is apparently caused by a strong solvation effect due to the interaction of the negative end of the permanent dipole of the water molecule with the alkali metal cations.

6984 APTIC NUMBER 15814

Peri, J. B.
INFRARED STUDY OF ADSORPTION OF CARBON DIOXIDE, HYDROGEN CHLORIDE, AND OTHER MOLECULES ON 'ACID' SITES ON DRY SILICA-ALUMINA AND GAMMA-ALUMINA. J. Phys. Chem., 70(10):3168-3179, Oct. 1966. 3 refs. (Presented at American Chemical Society, 145th National Meeting, New York, Sept. 1963.)

The adsorption of various molecules on transparent aerogel plates of dry, high-area silica-alumina and gamma-alumina was studied by infrared and gravimetric techniques. Carbon dioxide was selectively and reversibly adsorbed on a few so-called acid sites on both silica-alumina and gamma-alumina, producing an infrared band near 2375 reciprocal cm for silica-alumina and near 2370

reciprocal cm for gamma-alumina. Use of adsorbed CO2 as an indicator allowed titration of these 'alpha' sites with other adsorbates which displaced carbon dioxide. The sites on silica-alumina selectively adsorbed carbon dioxide, acetylene, butene, benzene, and hydrogen chloride. They also strongly adsorbed ammonia and water, but these adsorbates were also held by many other sites. Their reaction with hydrogen chloride produced hydroxyl groups. Their surface concentration fell in the range 3-9 times ten to the twelfth power/sq cm. Similar sites on gamma-alumina predried at 800 degrees had a surface concentration of about 5 times ten to the twelfth power/sq cm. The alpha sites are apparently formed by condensation of Al-OH groups during dehydration of the surface. They contain a reactive oxide ion (or ions) in close proximity to an exposed aluminum ion. Their role in catalysis is not yet clear. (Author abstract modified)

6985 APTIC NUMBER 15868

Perkins, Granville A.
SEPARATION OF ACID GASES. (Carbide & Carbon Chemicals Corp., New York) U. S. Pat. 1,951,992. 2p., March 20, 1934. (Appl. July 15, 1931, 14 claims).

A process for separating acid gases such as CO2, SO2, and H2S from gas mixtures uses an amine absorbent which can be regenerated. The acid gas is brought into contact with an amine containing more nitrogen than carbon atoms in its molecule and belonging to the group of compounds formed by the interaction of ethylene dichloride and ammonia, followed by the freeing of the amine by treatment with a caustic. The absorbent can be an open-chain or ring compound. Suitable equipment for effecting contact between the gas mixture and the absorbent are packed towers, spray towers, or tray-containing towers. The process removes practically all the gaseous constituents. To recover the gases and regenerate the absorbent, the absorbent is heated to 100 C or higher in the pressure of water. Any evolved water vapor is returned to the solution by means for reflux condensor. The method is efficient and economical.

6986 APTIC NUMBER 15141

Perry, E. J.
A LOW TEMPERATURE REFRIGERATING PLANT FOR AN ATOMIC DIFFUSION PROCESS. J. Refrig., no. 1:15-18, Nov.-Dec. 1957.

In the separation of uranium isotopes, refrigeration at -85 F is necessary, requiring an evaporating temperature of about -95 F. A plant installation is described in which this is accomplished by a two-stage refrigeration system using Arcton 4 as the refrigerant. The plant is capable of eliminating about 700,000 BTU/hr on the cooling cycle when supplying trichlorethylene as secondary refrigerant to the process plant at -85 F; the refrigeration load is spread over five lines of equipment, one complete line acting as a standby unit. The five first-stage machines are four-cylinder, 12-1/2-in. bore, 8-in. stroke, single acting Arcton 4 compressors, having air-cooled cylinders incorporating manually operated, half-duty valves; each is driven by a 75 h.p. motor through vee ropes. The approximate operating pressures are 2.86 and 25 lb/sq in. respectively in L. P. suction and discharge lines. The 5 second-stage compressors consisted of twin cylinder, 9-in. bore, 8-in. stroke machines, each powered by a 90 h.p. motor, with h.p. suction and discharge pressures of 23 and 210 lb/sq in. respectively, under full-load operating conditions. A principle of low-pressure float operation throughout the whole installation was adopted in order to achieve positive mechanical control of the refrigerant, and to eliminate the pressure drop that would be expected if a direct expansion coil type unit were used. For reasons of costs and delivery, commercial-grade steel was used in equipment manufacture. Details of the plant, of oil separation aspects, thermal expansion, the evaporators, the trichlorethylene circuit, and testing procedures are given together with a flow diagram of the process.

6987 APTIC NUMBER 15071

Phelps, A. V.
THEORY OF GROWTH OF IONIZATION DURING LASER BREAKDOWN. In: Physics of Quantum Electronics. P. L. Kelley, B. Lax, and P. E. Tannewald (eds.), New York, McGraw-Hill, 1966, p. 538-547. 32 refs.

Theoretical calculations are made of the rate of growth of ionization by electron impact with atoms and molecules in the presence of an intense laser beam. The excitation and ionization coefficients are calculated using Holstein's formula for the free-free absorption coefficient and using previously determined elastic- and inelastic-scattering cross sections. The agreement with experimental measurements of the time of breakdown is satisfactory if one assumes that initiating electrons are readily produced by the laser and that some of the atoms or molecules excited by electron impact are immediately photoionized. Resolution of the photoionization theory will require experiments using a laser having a smoother time and spatial variation of intensity in the focal region than those previously used. (Author abstract modified)

6988 APTIC NUMBER 15114

Polanyi, J. C.
PROPOSAL FOR AN INFRARED MASER DEPENDENT ON VIBRATIONAL EXCITATION. J. Chem. Phys., vol. 34:347-348, 1961. 16 refs.

An iraser is proposed which involves the inversion between vibrational states. The vibrational iraser facilitates the attainment of the necessary higher concentration of vibrational species, affords a wide frequency range, and in pulsed operation, improves possibilities as a coherent amplifier in view of the mean-life for spontaneous emission. Two types of vibrational inversion are distinguished, complete inversion with respect to an entire vibrational-rotational bands and partial inversion with respect to a restricted number of vibrational-rotational transitions within a band. If the products of the chemical reaction as originally formed are in an inverted populated distribution, the experimental conditions which would be expected to favor the maintenance of a stationary condition of

inversion are: (1) low temperature and pressure to minimize collisional deactivation, with fast flow beyond the reagent mixing point, and (2) a pulsed reaction followed by synchronized pulsed operation as an iraser. If the method of vibrational excitation does not result in an initial population inversion, a complete population inversion under stationary-state conditions might in principle be brought about by (3) specific depopulation of some vibrational levels below the highest populated level by inelastic collisions, or (4) by specific depopulation by chemical reaction of the vibrators within a limited range of vibrational levels below the highest populated level. In addition, (5) 'partial cooling' should be a more general method, though it only offers the possibility of achieving partial inversion where none existed before.

6989 APTIC NUMBER 14374

Polanyi, M. and K. Welke
ADSORPTION, HEAT OF ADSORPTION AND BONDING CHARACTER OF SULFUR DIOXIDE TO CARBON AT LOW CONCENTRATIONS. (Adsorption, Adsorptionswaerme und Bindungscharakter von Schwefeldioxyd an Kohle bei geringen Belegungen). Text in German. Z. Physik. Chem. (Leipzig), vol. 132:371-383, 1928. 6 refs.

The adsorption isotherms and heats of sulfur dioxide were studied beginning at concentrations of several ten-thousandths to 3% of the maximum value. The measurements were performed at extremely small pressures to exclude the influence of condensation. Alternate measurements at 0 C and 5.3 C were taken. The equilibria were slowly established, and the process usually required 2 to 3 hrs and at times even 2 to 3 days. Three series of measurements were taken, using about 15 g charcoal heated to 750 C prior to measurement in a vacuum to drive off adsorbed air. The results showed that at very small concentrations (about 0.0005 of the maximum quantity) the adsorbed substance is bound by high energy (20,000 cal) forces. The chemical binding at this stage is rigid. With increasing concentration (to 0.0008 of the maximum quantity), the adsorbed amounts are bound with much lower adsorption heats which may drop to 6000 cal. This chemical bond is characterized by mobility, so that the adsorbed quantity must be conceived as a two-dimensional gas which fills the available space to a large extent. With further increase in concentration (to about 0.001 to 0.03 of the maximum quantity), the formation of a condensed layer becomes discernible. The development of evaporation heat becomes apparent by increase of the adsorption heat to 11,000 cal. The mobility of the adsorbed molecules decreases at the same time.

6990 APTIC NUMBER 16631

Pond, William P.
A METHOD FOR THE DETERMINATION OF THE QUANTITY OF SULPHUR DIOXIDE GAS ABSORBED BY A LIQUID. Chemist-Analyst, 18(4):10-11, July 1929.

In the method described, a suction flask is filled with a 600-ml caustic soda solution containing 40 grams of caustic soda free of sulfites and bisulfites, and a bottle is filled with an accurately measured 50-ml portion of the solvent to be used. A flow of cooling water is started in a carefully positioned 600-mm long Liebig condenser. A very exactly measured volume of liquid sulfur dioxide (20 ml or 29.8 grams) is then placed in an oil tube, and then immediately hooked up to the system. The liquid SO2 will start boiling and will pass into the bottle where it will be absorbed by the solvent until the oil tube is free from the SO2. At this point, the solvent is thoroughly saturated with SO2 at an indicated and desired temperature and the excess will have passed up through the condenser into the suction flask where it will be absorbed by the caustic soda solution. Thus no SO2 is lost, and by knowing the original amount taken and determining the excess in the suction flask combined with the caustic soda as alkali bisulfite, the actual amount of SO2 dissolved by the solvent is readily determined. Further details of the method are noted briefly, and the method for calculating the results is outlined.

6991 APTIC NUMBER 14640

Popkovich, G. A., V. V. Sviridov, and T. N. Vorob'yeva
EFFECT OF HYDROTHERMAL ACTION ON THE SORPTION PROPERTIES OF MAGNESIUM HYDROXIDE. (Vliyaniye gidrotermal'nogo vozdeystviya na sorbtsionnyye svoystva gidrookisi magniya). Text in Russian. Vestsi Akad. Nauk Belarusk. SSR: Ser. Khim. Navuk, no. 4: 113-116, 1967. 5 refs.

The sorptive activity of magnesium hydroxide was found to be increased by hydrothermal processing at pressures of 5-20 atm. Causes for the increase in sorptive capacity of activated $Mg(OH)_2$ were studied using x-ray, thermogravimetric, thermographic, and electron microscopic methods. An observed increase in specific surface area was accompanied by a decrease in effective pore radius and an increase in porosity. The appearance of a large number of minute lamellar particles, differing in shape and size from the starting material, was observed. The sorption studies were made with carbon tetrachloride vapor.

6992 APTIC NUMBER 15019

Porter, G. and J. I. Steinfeld
GIANT-PULSE-LASER FLASH PHOTOLYSIS OF PHTHALOCYANINE VAPOR. J. Chem. Phys., vol. 45:3456-3457, 1966. 6 refs.

Flash photolysis was conducted on phthalocyanine gas to investigate the radiationless processes. Conventional flash photolysis, using a 220-J discharge through flash tubes filled with 3 torr of oxygen, produced a depletion of singlet absorption followed by extremely rapid recovery, faster than could be resolved by the apparatus. When a Q-switched ruby laser flash passed through the vapor, a large, fast depletion of absorbing molecules was observed, followed by a slow recovery. The slow recovery is due to the vaporization of excess solid in the sample tube and subsequent diffusion of the vapor into the absorbing region; thus, the laser flash irreversibly decomposes a large fraction of the phthalocyanine molecules in its path.

If the Q-switch is removed from the laser and the full 40-J pulse is passed through the sample, no decomposition is observed. This strongly suggests that a process involving two photons is responsible for the photodissociation. When a similar experiment is carried out in chloronapthalene solution at 25 C, the singlet absorption recovers more quickly, and there is apparently no photodissociation. A possible explanation for this, suggested by the observation that the fluorescence yield decreases by a factor of 77 in going from solution at 25 C to vapor at 450 C, is that the second photon is absorbed by a metastable state M1, which could be the lowest triplet or a singlet of different electronic symmetry, producing a state M2, which dissociates. Since the crossing rate has an apparent activation energy of 4.5-7.5 kcal/mole, this process will be favored at high temperatures. An additional effect which might be operative is the rapid relaxation of M1 by solvent. This mechanism is supported by our results for conventional flash photolysis of tetraphenylporphyrin at 310-350 C, which absorbs at 4010 A.

6993 APTIC NUMBER 15988

Porter, George
THE MECHANISM OF CARBON FORMATION. In: Combustion Researches and Reviews 1955. London, Butterworth, 1955, Chapt. 10, p. 108-123. 26 refs. (Presented at the 6th and 7th AGAPI Combustion Panel Meetings, Scheveningen, The Netherlands, May 1954 and Paris, Nov. 1954, AGARDograph no. 9.)
CFSTI, DDC: AD 688925

Chemical processes leading to carbon formation in five systems are reviewed and experiments in flash pyrolysis of ketone, acetone, and diacetyl are summarized. The five systems considered are pyrolysis of pure hydrocarbons, pyrolysis of acetylene, diffusion flames, explosion in closed vessels, and pre-mixed flames. It is contended that previous theories of mechanisms of carbon formation are incorrect, since they require the intermediate formation of polymeric hydrocarbons. When the time for half reaction is one second or less, the pyrolysis of hydrocarbons results in decompositon, and not polymerization; decomposition leads to the formation of acetylene and hydrogen before carbon formation. These hypotheses are supported by the flash pyrolysis experiments which showed that acetone and diacetyl formed ethylene and acetylene and ketone formed acetylene. Absorption spectra of the reactions occurring during flash pyrolysis of acetylene show the formation of carbon and hydrogen without intermediate hydrocarbon polymers. It is concluded that solid carbon is formed from acetylene by simultaneous combustion and dehydrogenation. Carbon formation in explosions of hydrocarbons with oxygen occurs by pyrolysis of the hydrocarbon in the same way as in the absence of oxygen. The relative rate of this mechanism compared with the oxidation of the hydrocarbon and carbon determines the amount of carbon finally formed. Carbon formation in a diffusion flame occurs by the same pyrolytic mechanism unless the fuel is near to, but less than, 1000 C. Homogeneous explosions are chemically similar to carbon formation in pre-mixed flames. The fact that carbon particles formed during combustion and homogeneous gas-phase pyrolysis are very similar in shape and diameter supports the view that the same mechanism is common to all processes.

6994 APTIC NUMBER 15024

Porter, R. N.
THEORETICAL STUDIES OF HOT-ATOM REACTIONS. I. GENERAL FORMATION. J. Chem. Physics, 45(6):2284-2291, Sept. 15, 1966. 23 refs.

Reactions of atoms excited translationally by photolysis or nuclear recoil (i.e., hot-atom reactions) offer information about collision dynamics different from that derived from studies of thermally activated processes. However, only approximate models have been available for interpreting hot-atom experiments. The imminent possibility of correlating hot-atom results with beam and thermal kinetic theory to obtain dynamic information and to test theoretical models necessitates a general theory without restrictive approximations. The theory developed in the present investigation is free of restrictions on the energy range and applicable to both the photochemical and nuclear recoil experiments. Unlike the neutron theory on which most theories of hot-atom chemistry are based, it takes into account both inelastic scattering and initial motion of target molecules. The temperature dependence of the integral-reaction probability is included in the formulation. The basic integral equation is solved by iteration for the integral reaction probability (relative yield) as a function of hot-atom energy.

6995 APTIC NUMBER 14526

Postnikov, V. P., T. I. Kunin, and A. A. Astasheva
THE CONTACT CAPABILITY OF CHROMIC OXIDE FOR THE OXIDATION OF SO2 TO SO3. (O kontaktiruyushchey sposobnosti okisi khroma dlya okisleniya SO2 v SO3). Text in Russian. Zh. Prikl. Khim., 9(8):1373-1377, 1936. 10 refs.

The catalytic activity of chromic oxide in the oxidation of sulfur dioxide depends on the starting materials and the method of preparation. Greatest activity was given by a chromic oxide gel precipitated with ammonia on heating; chromic oxide gels precipitated with sodium or potassium hydroxides had a much lower contact property. Water vapor increases the activity of pure chromic oxide, shifting the curve of contact in the direction of higher temperatures in comparison with operation in dry gas. Activation of the chromic oxide gel, precipitated by ammonia, by the acetates of calcium, zinc, aluminum, and nickel does not improve the contact properties of chromic oxide. The activity of chromic oxide precipitated with sodium hydroxide increases in the presence of activators but does not attain the level of activity of pure chromic oxide precipitated with ammonia.

6996 APTIC NUMBER 16607

Powell, H. M.
THE STRUCTURE OF MOLECULAR COMPOUNDS. PART IV. CLATHRATE COMPOUNDS. J. Chem. Soc., 1948:61-73, 1948.

Molecules firmly united to each other without the operation of strong attractive forces between them but through the enclosure

of one by the other, of both by each other, or in more complex ways are discussed. The space arrangements are such that it is impossible to separate the different components without overcoming the strong attachment, for example, by hydrogen bonds of the molecules of one component only which are thus joined to form an enclosing structure around the others. The conditions of formation, the compositions, and some properties of the compounds, hexamthylisocyanidoferrous chloride trihydrate (I), alpha-quinol, quinol with small molecules, quinol-formic acid- carbon monoxide, quinol-carbon dioxide, phenols and hydrogen bromide, amines and aminophenols with sulfur dioxide, and cholelc acids are discussed. Among the examples are those in which either two or more identical giant molecules interpenetrate and enclose each other, and others in which cage structures of suitable form imprison molecules of a second kind to give compounds of either fixed or variable molecular ratios. It is suggested that the molecules should be named clathrate compounds which are enclosed or protected by cross bars of a grating. (Author abstract modified)

6997 APTIC NUMBER 14382

Pozin, M. E., B. A. Kopylev, and G. V. Bel'chenko
ABSORPTION OF NITROGEN OXIDES WITH A SODA SOLUTION IN A FOAM APPARATUS FOR THE PRODUCTION OF SODIUM NITRATE. (Pogloshcheniye okislov azota sodovym rastvorom v pennom apparate dlya proizvodstva nitrata natriya). Text in Russian. Tr. Leningr. Tekhnol. Inst. Imen. Lensoveta, vol. 36:120-32, 1956. 12 refs.

A foam apparatus proved effective for the alkaline absorption of nitrogen oxides for the purpose of producing nitrates and decreasing the loss of nitrogen oxides in the production of nitric acid. The coefficient of efficiency of a single platform-cascade apparatus was decreased from 30 to 16% on increasing the linear gas flow rate from 0.5 to 3 m/sec in a cross section of the foam apparatus. The coefficient of absorption increases with increase in the linear flow rate of the gas, attaining a value of 1860 kg/sq m-hr-kg/cu m, which was approximately 6-7 times larger than the value of the absorption coefficient for a packed column under laboratory conditions, and 20-25 times greater than for factory-type scrubbers. With increase in the rate of flow of the liquid, the efficiency of a single platform of the apparatus and the coefficient of absorption increased insignificantly. Thus, increase in the rate of flow of the liquid by 3 times (from 1 to 3 cu m/hr) at a gas flow rate of 1 m/sec leads to an increase in efficiency of 22-24%. Increase in the concentration of absorbent in solution from 5 to 20% Na2CO3 at a linear gas flow rate of 1 m/sec leads to a decrease in efficiency from 26 to 16%. Correspondingly, the coefficient of absorption is also decreased. If the initial concentration of nitrogen oxides in the gas is increased from 0.05 to 1.4% at a linear gas flow rate of 1 m/sec, the value of the efficiency of a single platform of the apparatus increased from 8 to 25%. Choice of the number of platforms in the apparatus can be based on the data for a single platform in accordance with the required degree of absorption of nitrogen oxides.

6998 APTIC NUMBER 16419

Pozin, M. Ye., Y. P. Mukhlenov, and L. S. Vasilesku
OXIDATION OF SULFUR DIOXIDE IN IRON SULFATE SOLUTION. (Ob Okislenii sernistogo angidrida v rastvore sul'fatov zheleza). Text in Russian. Zh. Prikl. Khim., 28(7):681-686, 1955. 7 refs.

The oxidation of SO2 in the presence of iron ion was studied experimentally. The following optimum conditions were established for simultaneous processing of waste gases and pickling solutions: 1) during oxidation of FeSO4 to Fe2(SO4)3 - temperature from 60-80 C, incoming SO2:O2 ratio of 1:5, an initial concentration of ferrous sulfate up to 18% does not affect the course of the reaction; 2) during sulfuric acid formation - temperature from 80-90 C, SO2:O2 ratio equal to 1:4, optimum iron ion concentration, 10-30 g/liter. An acid formation rate of about 1000 kg of sulfuric acid monohydrate from a cubic meter of reaction volume was achieved in the laboratory under optimum conditions. These experiments demonstrate the advisability of examining the reaction of SO2 exhaust gas with spent pickling solutions under plant conditions for the purpose of recovering the pickling solutions or for producing dilute sulfuric acid and crystalline ferric sulfate.

6999 APTIC NUMBER 14883

Prausnitz, J. M.
REGULAR SOLUTION THEORY FOR GAS-LIQUID SOLUTIONS.
Am. Inst. Chem. Engrs. J., 4(3):269-272, Sept. 1958.
14 refs.

The extension of Hildebrand's equations to solutions of nonpolar gases in nonpolar liquids is presented. The aim of the solution theory is to predict the thermodynamic properties of a solution using only data for pure components. It provides a simple means for estimating the solubility of gases in liquids and for determining approximate values of the temperature coefficient of gas solubility. The difficulties encountered when applying regular-solution equations to solutions of gases in liquids can be overcome by considering the mixing process as an isothermal process in a series of three steps. The first is isothermal compression of the pure gas from its partial pressure and the pure liquid from its vapor pressure to the isometric mixing pressure. The second step is the isothermal, isometric, and isopiestic mixing of the pure components at the isometric mixing pressure. The final step is the isothermal expansion of the solution from the isometric mixing pressure to the equilibrium pressure. Since the theory of regular solutions makes a variety of assumptions, it can only approximately describe the thermodynamic behavior of nonpolar solutions. The solubilities of gases and their temperature coefficients can therefore only be estimated by the given equations. The regular-solution equations as discussed are not applicable for exact quantitative work. The main uses of these equations for chemical engineering purposes are to extend available data to new conditions and to make preliminary phase-equilibria estimates for nonpolar systems having no existing data.

7000 APTIC NUMBER 15989

Pressman, J., C. Schuler, and T. Wentink
STUDY OF THEORY AND APPLICABILITY OF LASER TECHNIQUE FOR MEASURING ATMOSPHERIC PARAMETERS. (INTERIM SCIENTIFIC REPORT). GCA Corp., Bedford, Mass., Technology Div., Contract NAS12-540, GCA-TR-68-6-N, 168p., Oct. 1968. 213 refs.
CFSTI: N69-21683

A systematic analysis of the absorption characteristics of atmospheric constituents was undertaken as part of a program designed to effect an understanding of laser energy interactions in the atmosphere. The derived results will be applied to the development of modulated, coherent, ground-based laser communications links in planetary atmosphere. Among laser transmission, scatter modes are resonant interactions capable of degrading the transmissivity of the atmospheric medium. To evaluate this problem and identify optimal communications systems operation wavelengths, atmospheric constituents were characterized as potential resonant scattering species. A bibliographic survey is included of the literature on molecular species and transitions of interest in laser energy-atmospheric constituent interaction problems. Augmented theoretically, the survey is a source of appropriate techniques for obtaining data on major and trace atmospheric constituents. Also reported are the planetary atmospheric parameters most amenable to investigation. These parameters are discussed in sections on a mathematical analytical treatment of general laser probe problems; Raman probing by laser; measurement of isotopes by laser resonant scattering; laser probing for specific molecules, in particular MgO; and the feasibility of measuring the ambinet wind field from a ground-based laser site.

7001 APTIC NUMBER 15496

Prokop'yeva, M. F. and V. K. Bukina
SELECTION AND TESTING OF SOLID CARRIERS IN THE CHROMATOGRAPHY OF CORROSIVE INORGANIC GASES. (Podbor i ispytaniye tverdykh nositeley v khromatografii agressivnykh neorganicheskikh gazov). Text in Russian. Uzbeksk. Khim. Zh., no. 4:51-53, 1967. 4 refs.

Studies were made with pumice, quartz, zeolite, porous teflon, Estonian mineral carriers K1 and K2, diatomaceous brick and, kieselguhr. The brick, kieselguhr, pumice, and quartz were subjected to boiling with hydrochloric acid (1:1) for 6 hrs. After washing to remove chloride ion, they were heated for 2-3 hrs at 900 C (pumice at 400 C). The other carriers were not pretreated. The criterion for inertness of the carrier was the retention time of the gaseous component relative to that of air. Distortion of the absorption isotherm was evaluated in terms of the Kestner coefficient of asymmetry. Pretreated brick, kieselguhr, and pumice revealed linear absorption isotherms for all components (CO2, Cl2, NOCl, HCl, SO2) with the exception of NO2, which is irreversibly absorbed. Teflon, K1, and K2 show linear absorption curves without preliminary treatment and are recommended for the analysis of gas mixtures containing NO2.

7002 APTIC NUMBER 14557

Protsenko, P. I. and G. K. Shurdumov
DIFFERENTIAL THERMAL ANALYSIS OF BINARY SYSTEMS OF ALKALI METAL AND STRONTIUM NITRITES. (Differentsial'nyy termicheskiy analiz dvoynykh sistem iz nitritov shchelochnykh metallov i stronstsiya). Text in Russian. Zh. Neorgan. Khim., 9(7):1692-1695, 1964. 11 refs.

Diagrams of state, based on data from thermal analysis, are plotted for the following binary systems: Sr(NO2)2-NaNO2, Sr(NO2)2-KNO2, Sr(NO2)2-RbNO2, and Sr(NO2)2-CsNO2. The following compounds were verified: 2NaNO2.3Sr(NO2)2, 3KNO2.2Sr(NO2)2, 3RbNO2.2Sr(NO2)2, CsNO2.Sr(NO2)2, and 2CsNO2.Sr(NO2)2. Heats of formation for these compounds are as follows: plus 4.351, -3.003, -7.383, -2.430, and -1.845 kcal/mole, respectively.

7003 APTIC NUMBER 15443

Protsenko, P. I. and A. V. Protsenko
ON DETERMINING THE THERMAL STABILITY OF SALT MELTS. (K voprosu ob opredelenii termicheskoy ustoychivosti rasplavov soley). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii, Khim. i Khim. Tekhnol., 8(1):160-161, 1965. 9 refs.

The practicability of determining thermal dissociation of salt melt by detecting the sharp drop in electroconductivity upon liberation of gaseous products of decomposition was demonstrated experimentally. The following dissociation temperatures (deg C) were determined by this method: LiNO3, 412; NaNO3 557, KNO3, 561; PbNO3, 550; CsNO3, 515; TlNO3, 487.

7004 APTIC NUMBER 16530

Rai Dastidar, T. K., P. K. Bhattacharyya, and A. K. Barua
HEAT CONDUCTIVITY OF THE SLOWLY DISSOCIATING SYSTEM 2NO2 IN EQUILIBRIUM WITH 2NO + O2 FROM 200 TO 400 C. Trans. Faraday Soc., 65(563):2913-2917, Nov. 1969. 12 refs.

The thermal conductivity of the slowly dissociating system 2NO2 in equilibrium with 2NO + O2 was measured at 200-400 C and at various pressures by the hot-wire technique. On comparing the experimental data with theories of heat transfer in reacting gases, it was found that the effect of chemical reaction on heat conductivity is apparent at 350 C and above, but negligible at 300 C and below. Theories regarding the role of chemical enthalpy at high temperatures are inadequate for a quantitative explanation of the experimental results. (Author abstract modified)

7005 APTIC NUMBER 15480

Ramakrishna, T. V., Philip W. West, and James W. Robinson
THE DETERMINATION OF CALCIUM AND MAGNESIUM IN ACETYLENE FLAMES. Anal. Chem. Acta., vol. 40:347-350, 1968. 1 ref.

Results are reported of investigations with air-acetylene and nitrous oxide-acetylene flames for the determination of calcium and magnesium by atomic absorption spectrometry. The concentrations of Ca and Mg used were 4 ppm and 0.4 ppm, respectively. The results indicate that the determination of Ca and Mg with acetylene flames is more selective than with oxy-hydrogen flames. The decrease in chemical interference in nitrous oxide-acetylene flame is particularly noteworthy, although care must be exercised in the presence of alkali metals which are associated with most samples analysed for Ca and Mg. Errors due to the presence of alkali metals can be overcome by preparing standards and samples to contain 0.5% SrCl2 or 0.4% EDTA (disodium salt). The presence of EDTA and/or SrCl2 also overcame all the interferences in calcium and magnesium determinations with air-acetylene flames. (Author abstract modified)

7006 APTIC NUMBER 15714

Ramsden, A. R.
APPLICATION OF ELECTRON MICROSCOPY TO THE STUDY OF PULVERIZED-COAL COMBUSTION AND FLY-ASH FORMATION. J. Inst. Fuel, 41(335):451-454, Dec. 1968. 7 refs.

A brief description is given of a probe and sampling technique for collecting particles from the gas stream of a pulverized-coal-fired test rig for direct examination by transmission electron microscopy. The technique is of value in studying the combustion of pulverized-coal particles and the formation of fly-ash. Initial experimental observations, made during combustion of some New South Wales bituminous coals, are presented. (Author's Abstract)

7007 APTIC NUMBER 15796

Ratney, Ronald S., Miriam Fredrica Godshalk, Joan Joice, and Kenni Ward James
THE USE OF 2,4-DINITRO-5-FLUOROANILINE IN THE DETERMINATION OF PROTEIN STRUCTURE ON A MICRO SCALE. Anal. Biochem., 19(2): 357-365, 1967. 11 refs.

The use of 2,4-dinitro-5-fluoroaniline as a reagent for the determination of N-terminal groups in proteins and peptides on an ultramicro scale is reported. The compound was reacted with amino acids and proteins to produce N-2,4-dinitro-5-aminophenyl (DNGP) derivatives, including 20 amino acid derivatives. Three solvent systems which can effect the separation of DNAP amino acids on thin-layer chromatograms were developed. DNAP insulin was also prepared and it was found that the N-terminal amino acids can be determined starting with 50 micrograms of this derivative or 100 micrograms of insulin. The color of DNAP amino acids can be intensified on thin-layer chromatograms by first exposing the chromatograms to nitrogen dioxide fumes and then spraying with a solution of beta-naphthol and triethylamine in benzene. This permits the detection of as little as 0.1 micrograms of DNAP amino acid. (Author summary modified)

7008 APTIC NUMBER 15869

Reed, Cortes F.
METHOD OF REACTING AROMATIC HYDROCARBONS. (Charles L. Horn, Minneapolis, Minn.) U. S. Pat. 2,174,111. 2p., Sept. 26, 1939. (Appl. May 25, 1936, 6 claims).

A method of forming benzene derivatives directly in the presence of an oxide of sulfur, tellurium, and selenium, while controlling the temperature of the reaction to prevent polymerization, is described. The method also provides a means of preparing chlorobenzene substitution products, particularly chlorobenzenes which give a high yield and require a minimum number of steps in its preparation. The method consists of reacting an aromatic hydrocarbon with a vapor mixture of chlorine and an oxide of sulfur, selenium, or tellurium at room temperature. The temperature of the reaction is limited to 70 C. The passage of the mixture into the reaction medium is continued until crystalline products are precipitated.

7009 APTIC NUMBER 16296

Rickert, Hans and Carl Wagner
A STUDY OF THE KINETICS OF SILVER SULFIDATION. II. THE INFLUENCE OF THE PENETRATION REACTION OF THE SILVER THROUGH THE PHASE BOUNDARY SILVER/SILVER SULFIDE. (Zur Kinetik der Sulfidierung von Silber. II. Der Einfluss der Durchtrittsreaktion des Silbers durch die Phasengrenze Silber/Silbersulfid). Text in German. Z. Physik. Chem. Neue Folge (Frankfurt), vol. 31:32-39, 1962.

The speed with which one-dimensional, compact silver sulfide layers develop during a reaction between silver and liquid sulfur was determined at 200 and 300 C by using the penetration reaction of silver through the phase boundary Ag/Ag2S and the movement of silver ions and electrons in Ag2S. The rate of Ag2S formation was computed up to very thick layers (5 cm) from the laws governing the three individual processes, such as (1) penetration of silver ions and electrons through the phase boundary Ag/Ag2S, (2) movement of silver ions and electrons through the compact Ag2S, and (3) inclusion of sulfur in the Ag2S lattice at the phase boundary Ag2S/S. The results agreed well with measurements conducted earlier. The linear time law for very thin layers (less than 0.1 cm) may be quantitatively expressed by assuming that the transition of the silver from the metallic state to Ag2S is the rate-determining process.

7010 APTIC NUMBER 16021

Rickles, R. N.
MOLECULAR TRANSPORT IN MEMBRANES. Ind. Eng. Chem., 58(6):18-35, June 1966. 169 refs.

This paper is a review of thy literature on the fundamental phenomena of solubility and diffusion which underlie both the barrier and separation function of membranes. Attention is focused on the behavior of amorphous and semicrystalline polymers. It is emphasized that while general permeatic processes are now

understood, it is not yet possible to write and solve appropriate equations for predicting permeation rates without significant experimentation. The vase amount of existing data on a number of specific systems must be expanded to include the almost infinite combinations of polymer and penetrant if general equations are to be developed. Research in this area is necessary to make wider use of the great abilities of membranes to make biological and industrial separations.

7011 APTIC NUMBER 16438

Rienaecker, Guenther
A STUDY OF THE CATALYTIC PROPERTIES OF MIXED OXIDIC CATALYSTS. (Zur Kenntnis der katalytischen Eigenschaften von oxydischen Mischkatalysatoren). Text in German. Chem. Tech. (Berlin), 11(5):246-250, May, 1959. 12 refs. (Presented at the Hauptjahrestagung 1958 der Chemischen Gesellschaft, Leipzig, Oct 28.)

The oxide mixture NiO/Al2O3 was studied to determine the catalytically active intermediate stages and the influence of lattice defects on the catalytic properties of NiO. The dissociation of N2O was used as a test reaction. The oxides were mixed at a ratio of 1:1 and preheated to temperatures between 400 and 1200 C. Radiographic analyses showed that spinel formation begins at 1050 C and is completed between 1200 and 1400 C. No formation of highly dispersed products was observed. The van Arkel dissociation was present at all times. The lattice constants showed no deviation from the theoretical values. The entire surface decreased uniformly and slowly up to a temperature of 1050 C. Above 1050 C, the decrease was much more pronounced, though still gradual. Not the slightest indication of catalytically active intermediate stages was recorded. Beginning at a temperature of 800 C, the catalytic activity began to diminish. For determining whether this was due to aluminum oxide, 1, 5 and 10 parts per thousand of Al2O3 were added to NiO. Electric conductivity measurements were taken on tablets formed from the mixture which was heated to 1000 C. Compared to the conductivity of pure NiO, that of the various mixtures decreased considerably. The measurements permitted the conclusion that the number of lattice defects was reduced by the addition of aluminum oxide.

7012 APTIC NUMBER 15793

Riepe, Mary Ellen and Jui H. Wang
INFRARED STUDIES ON THE MECHANISM OF ACTION OF CARBONIC ANHYDRASE. J. Biol. Chem., 243(10):2779-2787, May 25, 1968. 19 refs.

By accurately measuring the difference infrared spectrum of CO2 equilibrated bovine carbonic anhydrase against the ethoxzolamide- or azide-inhibited enzyme, the absorption maximum of the enzyme was obtained at 2431 reciprocal cm; this maximum is due to the asymmetric stretching f the CO2 molecule loosely bound to a hydrophobic surface at the active site of the enzyme. CO2 dissolved in water absorbs at 2343.5 reciprocal cm. The observed small shift for bound CO2 is attributed to a solvent effect. The absence of a larger spectral shift shows that this substrate is not appreciably distorted upon binding by the enzyme. Thy binding constant of carbonic anhydrase for CO2 is estimated directly from the difference spectra taken at various CO2 pressures. Nitrous oxide competes with CO2 for binding to this enzyme with approximately the same affinity. In addition to ethoxzolamide, nitrate, bicarbonate, azide, and other sulfonamide inhibitors also prevent the formation of the enzyme-substrate complex. Azide ion, both free and bound to metal-ion complexes, also absorbs strongly in this infrared range. A comparison between the infrared spectra of azide bound to the diethylenetriamine Zn(II) and Co(II) complexes or to the cobalt-enzyme and the corresponding spectrum for the native enzyme shows that the azide ion is coordinate to the Zn(II) atom of the native enzyme. Examination of the difference spectra in the presence of both azide and CO2 shows that the bound azide sterically interferes with the binding of CO2 in the hydrophobic cavity adjacent to the Zn(II). Based on infrared data on the competition of bicarbonate and hydroxide with azide for Zn(II), combined with the results of CO2 binding is proposed. A simple molecular mechanism for the catalytic action of carbonic anhydrase. The OH group coordinated to the zinc ion attachs the cound CO2 converting it to HCO3(-) in a reverse hyperation reaction. (Author summary modified)

7013 APTIC NUMBER 16026

Robock, Klaus
DETERMINING THE ELECTRON STRUCTURE OF SIO2 DUSTS BY LUMINESCENCE MEASUREMENTS. Staub (English translation from German of: Staub, Reinhaltung Luft, 28(11):14-19, Nov. 1968. 9 refs.
CFSTI: TT 68-50448/11

Measurements of spectral distribution of radio luminescence (the phenomena of fluorescence and phosphorescence) carried out on 16 samples of different SiO2 modifications show that characteristic luminescence bands at 330 nm, 390 nm, and 460 nm are associated with quartz, cristobalite, and tridymite. The position of the bands is independent of the impurity ions content of the samples. The higher the degree of lattice disorder, the higher the impurity of the bands. Quartz glass exhibits bands associated with the cristobalite structure, in addition to more or less distinct bands for range with quartz structure or tridymite structure. The luminescence process is explained. Compared with the previously used X-ray and infrared spectrographical methods, luminescence measurements promise improved determination of microcrystallite structure in quartz glasses. (Author abstract modified)

7014 APTIC NUMBER 14910

Rogers, L. B.
ELECTRODEPOSITION BEHAVIOR OF A SIMPLE ION. II. PRECIPITATION INTO A LIQUID ELECTRODE (MERCURY). J. Electrochem. Soc., 99(6):267-271, June 1952. 14 refs.

The possibility of improving certain electrolytic separations by adjusting the volumes of mercury and aqueous solutions before electrolysis is demonstrated. The goals of complete recovery

of an element and maximum improvement in the purity of a product must be compromised in a single-stage electrolytic separation of two elements whose polargraphic half-wave potentials are close together. The compromise can be less severe if an electrolysis is repeated more than once or if a countercurrent fractionation is performed. Conditions involved in changes in volume ratio can be rapidly evaluated by constructing graphs. The graphs are obtained by drawing for each element a solid line with a slope of 0.060/ number of electrons transferred by an atom in being oxidized through the value for its polargraphic half-wave potential. Such a line gives, at any potential, the ratio of the concentrations of that element in the aqueous phase and in the mercury on the left-hand ordinate. The only condition under which the use of a relatively large volume of mercury is justified is when the recovery of an element must be improved but the maximum potential at which the electrolysis can be carried out is limited. A decrease in volume ratio at any potential less cathodic than the half-wave potential decreases recovery of the metal with a moderate to slight gain in enrichment. At more cathodic potentials, the recovery of both elements is decreased without materially affecting enrichment. If the values of 50% of the electrode potential are close together, a countercurrent electrolytic fractionation will probably be required to obtain appreciable enrichment and recovery of a particular element. From the theory of separations, it is possible to calculate the number of equilibrium stages required for any degree of separation of the two elements. Theoretical limitations on separation arise from the neglect of activity coefficients and overvoltage, and the use of an equation based on the assumption that the deposit is entirely soluble in mercury. In practice, fractionation is limited by the small region of potential on both sides of the selected value which the automatic regulator cannot distinguish as being different from the selected value. Moreover, if mercury is stirred too vigorously, small droplets of amalgam may be detached from the electrode, requiring a longer period to reach a steady value for the distribution. In addition, recovery may be significantly less than predicted.

7015 APTIC NUMBER 16126

Bogier, J. and B. Leblanc
CHARACTERISTICS OF SOOTS COLLECTED IN INDUSTRIAL TYPE DIFFUSION FLAMES. (Caracteristiques des suies recueillies dans les flammes de diffusion de type industriel). Text in French. Rev. Gen. Thermique (Paris), 8(96):1113, 1143-1151, Dec. 1969. 7 refs. (Presented at the Societe Francaise des Thermiciens, Section Flamme et Combustion, Nov. 13, 1968.)

The properties of carbon-soot particles were studied. Particles were obtained either by fuel combustion or by natural gas combustion in a large capacity furnace. In both cases, the particles were the same size and their internal structure was amorphous. Their chemical nature is the only property which seems able to explain the differences recorded in the optical characteristics. The appendix presents information for the calculation of the relation between the carbon-soot concentration and the emitting factor of a lighting flame. (Author summary modified)

7016 APTIC NUMBER 13922

Rosenberg, R. E. and D. S. Hacker
FORMATION OF NITROGEN OXIDES IN AERATED METHANE FLAMES. Preprint, Am. Chem. Soc., Washington, D. C., Div. Fuel Chem., 10(3):91-103, 1966. 5 refs.

An investigation to determine the kinetics of the formation of nitrogen oxides produced in aerated methane flames is discussed. When a bunsen flame was used, NO formed in a narrow region near the outside edge of the flame and then diffused toward the center of the burner and into the secondary air stream where it was oxidized, forming NO2. Very little NO2 was found in the burning gas. Because the shape and position of the reaction zone from a bunsen flame made kinetic analysis difficult, the experimental work was changed to a flat flame. Nitrogen dioxide formed very close to the flame and then rapidly decomposed. Its concentrations decreased to zero with fuel-rich and stoichiometric primary mixtures. However, some NO2 was found at all heights above the burner with fuel-lean primary mixtures. Three observations were drawn from this stoichiometric flame: (1) NO2 is the nitrogen oxide formed in the flame; (2) NO2 decomposes to NO; and (3) NO is also formed by another mechanism in the combustion products above the flame.

7017 APTIC NUMBER 14558

Rosenqvist, Terkel
A THERMODYNAMIC INVESTIGATION OF THE SYSTEM SILVER-SILVER SULPHIDE. Metals Trans., vol. 185:451-460, Aug. 1949. 19 refs.

The thermodynamics of the silver-silver sulfide system were studied to obtain further data for metal/sulfur melts. Previous thermodynamic investigations of the reaction Ag2S plus H2 yields 2Ag plus H2S have been in poor agreement. The equilibrium ratio H2S/H2 is a measure of the escaping tendency of sulfur. Apparatus was designed in which the equilibrium gas ration was obtained by circulating the gas mixture over the specimen. The composition of the gas mixture was determined from its density by means of a buoyancy balance. A total of 22 samples containing up to 33.3% S were studied over a temperature range of 500-1300 C. The equilibrium ratios H2S/H2 were plotted as a function of temperature and as a function of alloy composition. The results show that the immiscibility region in the system has a critical temperature of about 1125 C which corresponds to a critical composition of 24% sulfur. The heat and standard free energy of the reaction were obtained from the experimental data and are expressed as a function of temperature. The heat and standard free energy of formation of Ag2S from the elements were calculated for room temperature. The partial heat content and chemical activity of sulfur in the liquid phase were computed and the corresponding values for silver were calculated by means of the Gibbs-Duhem equation. A model of the structure of silver-silver sulfide melts was suggested which was consistent with the observed thermodynamic data and also with the existence of immiscibility in the system. (Author summary modified)

7018 APTIC NUMBER 15028

Ross, Robert T.
SOME THERMODYNAMICS OF PHOTOCHEMICAL SYSTEMS. J. Chem. Phys., 46(12):4590-4593, June 15, 1967. 21 refs.

A limit on the thermodynamic potential difference between the ground and excited states of any photochemical system is established by evaluating the potential difference at which the rate of photon absorption and emission are equal. If incident-light intensity and absorption spectrum are known, the potential difference can be calculated from the Planck law relationship. The actual potential developed may be evaluated if the quantum yield of luminescence is known. Knowledge of this potential is particularly useful in analyzing the energetics of photosynthesis. This process can be reversed. From knowledge of a luminescence spectrum, it is possible to infer the absorption spectrum of the species responsible. Given the order-of-magnitude estimates for the luminescence yield and the extinction coefficient, it is possible to calculate the chemical potential difference required to generate the luminescence. This procedure is useful in examining mechanisms in electroluminescence, chemiluminescence, and bioluminescence.

7019 APTIC NUMBER 15438

Ross, Robert T.
THERMODYNAMIC LIMITATIONS ON THE CONVERSION OF RADIANT ENERGY INTO WORK. J. Chem. Phys., 45(1):1-7, July 1, 1966. 12 refs.

Factors affecting solar-energy conversion in photoelectrical and photochemical systems are reviewed. Sources of inefficiency in the transformation of light into work that can be considered in thermodynamic terms: are (1) directional radiation incident on a nondirectional absorber; (2) irreversibility necessary to get a directional flow of energy into work or free-energy storage; (3) internal resistance losses; and (4) energy leaks from the absorber. Efficiency, as defined by the amount of power stored, is most significantly affected by control of the thermodynamic potential at the locus of free-energy storage; indirectly, this means control of the absorber temperature. The latitude in this control for good efficiency in a photochemical system is given. Absorber directionality and absorber relaxation rate must change by at least an order of magnitude to significantly affect the thermodynamically limited maximum efficiency. The loss due to absorber relaxation in a given chemical system can be minimized by an appropriate choice of optical density for the absorber. Internal resistance losses can be reduced by removing some of the resistance, but the significance of such a reduction depends on the degree of saturation. An understanding of these sources of inefficiency is useful in designing radiation converters, and devising a simple photochemical system for the effective capture of solar energy. Relationships are developed for narrow-band absorption, and application to broad-band systems is discussed briefly. Information useful to biological photosynthesis can be obtained by studying the efficiency of a radiation-conversion system, or its chemical potential and fluorescence yield parameters, as a function of variables considered here. (Author conclusions modified)

7020 APTIC NUMBER 16478

Rossetti, Colette, Francoise Bourbonneux, Robert Farrena, and Pierre Barchewitz
MOLECULAR SPECTROSCOPY WITH A LASER SOURCE. MOMENT OF THE VIBRATION-ROTATION TRANSITION FOR THE 00(ZERO-TH ANGULAR MOMENTUM STATE)1 - 10 (ZERO-TH ANGULAR MOMENTUM STATE)0 TRANSITION OF CO2. (Spectroscopie moleculaire avec source laser. Moment de transition de vibration-rotation pour la transition 00(zero-th momenta etat angulaire)1 - 10 (zero-th momenta etat angulaire)0 de CO2). Text in French. C. R. Acad. Sc., Paris, Ser. B, 262(26): 1684-1686, June 27, 1966. 4 refs.

The absorption coefficient at the center of each of the spectral lines P(12) to P(24) and R (13) to R(25) of the 10(zero-th angular momentum state)0 - 00(zero-th angular momentum state)1 transition of carbon dioxide was determined by direct measurements of the intensity of radiation transmitted by the absorption chamber, first free of gas, then filled with carbon dioxide at progressively higher pressures. Knowledge of the values of the absorption coefficient enabled the calculation of the collision half-width, the integrated absorption, and the square of the moment of the vibration-rotation transition for each of these lines. The factor of vibration-rotation interaction was determined using these results.

7021 APTIC NUMBER 15182

Rothschild, Walter G.
GAMMA-RAY DECOMPOSITION OF PURE LIQUID SULFUR DIOXIDE. J. Am. Chem. Soc., 86(7):1307-1309, April 5, 1964. 14 refs.

Results of irradiations of pure liquid sulfur dioxide are reported. Pure liquid sulfur dioxide irradiated by Co60 gamma rays at - 17 deg disproportionates especially according to 3SO2 yields 2SO3 + S. The elemental sulfur precipitates in the shape of long needles. Analyses of the permanent gases by combustion techniques and mass spectrometry indicate that small amounts of molecular oxygen are also formed. This oxygen does not arise by recombination of O atoms in the spurs but, most likely, by the attack of O atoms on sulfur trioxide. The rate of formation of sulfur and sulfur trioxide is constant with dose up to at least 0.5% conversion of SO2 to SO3. The rate of formation of oxygen increases with dose. The G-values (100 ev yields) of the production of SO3, S, and O2 are approximately 1.31, 0.65, and 0.01, respectively. On the basis of a proposed reaction mechanism, which employs the species O and SO, the primary G-value of the decomposition of pure liquid sulfur dioxide is calculated to be 1.35. The ratio of the rate constants of the reaction steps O + SO3 and O + SO2 is estimated to be 10. (Author abstract modified)

7022 APTIC NUMBER 15506

Rottner, Gerard
CONTRIBUTION TO THE STUDY OF REACTIONS WITH A HETEROGENEOUS-

HOMOGENEOUS TYPE MECHANISM. (Contribution a l'etude de reactions a mecanisme heterogene-homogene). Text in French. Ann. Chim. (Paris), Ser. 12, vol. 2:730-756, Sept.-Oct. 1957. 13 refs.

For the purpose of refining the experimental technique and theoretical interpretation of the work of Bogoyavlenskaya and Koval'skiy, the reaction: SO2 + 3CO yields COS + 2CO2, catalyzed by aluminum at about 500 C, was studied. The reaction was carried out in a cylindrical reaction chamber provided with a thin coaxial rod in which the catalyst was deposited either 1) on the inner cylinder wall or 2) on the surface of the rod. A stoichiometric mixture of purified SO2 and CO was introduced into this cylinder and, in the course of the reaction, its pressure was measured by a platinum wire manometer, while the temperature difference of the cylinder wall and the axial rod in either case was measured by thermocouples. As an aid in the interpretation of these measurements, a purely homogeneous reaction, i.e., oxidation of CO by C2, and a purely heterogeneous reaction, i.e., oxidation of Cu by O2, were carried out in an analogous manner. Results of these tests are given in several tables and are discussed at length. It is shown that with certain realistic simplifying assumptions, the ratio of the heat released in the volume per unit time and the heat released on the surface of the catalyst per unit time, which is a measure of the 'degree of homogeneity' of a reaction, can be determined from the temperature differences measured in cases 1) and 2), in fact, this approach permits the determination of the 'degree of homogeneity' throughout the successive phases of a reaction. The reaction under study was found to assume an increasingly more marked heterogeneous character calling for an ever greater contribution of the catalyst to its progress.

7023 APTIC NUMBER 15403

Roubeix, G., R. Dore, and Y. Coche
APPLICATION OF CONVENTIONAL TECHNIQUES TO THE CONSTRUCTION OF A PILOT PLANT FOR THE ISOTOPIC SEPARATION OF URANIUM BY GASEOUS DIFFUSION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:375-379. (Translated from French.)

Classical procedures and apparatus used in the construction of a pilot plant for isotope separation are discussed. Considerable use was made of the techniques of high-vacuum and surface treatments. In order to avoid contamination of the uranium hexafluoride (UF6) and corrosion of the surface with which it is in contact, it was necessary to find a suitable solution to the problem of choice of materials and to establish a vacuum in the circuit. A secondary pressure rise in a vessel which was subjected to a high vacuum and then cut off from the pumps causes a phenomenon accounted for by real leaks and desorption. Real leaks in equipment or in assemblies in pilot plants are measured with a helium spectrometer. For desorption, chemical cleansing and chemical degassing were studied. The various elements which make up the pilot plant were first subjected to careful mechanical preparation. Thereafter, a series of chemical treatments took place with the object of eliminating any trace of grease and dissolving superficial oxide layers. The main purpose of the degassing process was to ensure the nearly complete removal of substances which have a high vapor pressure at the operating temperature or which might react with UF6, resulting in corrosive materials or powdery substances which would quickly reduce the permeability of the barriers. The pumping facility is under a vacuum and a study was undertaken to ensure operation of the equipment with special inert fluids which are markedly halogenated. The procedure for handling UF6 under low pressures and maintaining the temperature over 40 C in order to avoid any disturbing crystallization which would affect the equipment is described. An advantage of the procedure is that it permits instantaneous recycling of the UF6 in the cascade so that there is no disturbance of the established isotopic concentrations. Measurements having to do with UF6, which include absolute pressure, flow, temperature, chemical composition of the gas, and isotopic concentration are discussed. Operating conditions, such as vacuum tightness, corrosion resistance, and the need for remote transmission, are also considered.

7024 APTIC NUMBER 16378

Royter, V. A., M. A. Stukanovskaya, G. P. Korneychuk, N. S. Bolikovskaya, and G. I. Golodets
KINETICS OF SULFUR DIOXIDE OXIDATION ON PLATINUM CATALYST UNDER CONDITIONS OF STEADY CHEMICAL REACTION. (Issledovaniye kinetiki okisleniya sernistogo angidrida na platinovom katalizatore v usloviyakh ustanovivshegosya khimicheskogo ravnovesiya). Text in Russian. Kinetika i Kataliz, 1(3):408-417, 1960. 6 refs.

Radioactive sulfur was used to study the equilibrium oxidation of sulfur dioxide on a platinum grid; a flow-circulation method was used to study nonequilibrium oxidation. It was demonstrated that the kinetics in both cases are the same, indicating generality of the mechanism. Possible schemes for the process were proposed which satisfy both the kinetic dependences found and the principle of detailed balance. The limiting stage is the surface reaction of SO2 with oxygen, and not the reaction of any of the reaction components with the catalyst. Differences between heats of activation and rate constants for the equilibrium and nonequilibrium cases were explained as contamination of the platinum by oxygen under equilibrium conditions.

7025 APTIC NUMBER 15077

Rozen, A. M. and A. I. Mikhailichenko
VARIATION OF THE SEPARATION FACTORS IN ISOTOPE EXCHANGE AS A FUNCTION OF THE PROPERTIES OF THE MOLECULES BEING EXCHANGED. Soviet J. At. Energy (English translation from Russian of: Atomnaya Energiya), 18(2):180-190, Feb. 1965. 28 refs.

Variation of the equilibrium constant in isotope exchange in diatomic compounds is considered as a function of properties of the atoms and molecules being exchanged: the force constant, the dissociation energy, the electronegativity, the structure of the electron cloud, the internuclear distance, the mass of the isotopic atom, and the mass of the complementary atom. Semiempirical formulas are used to obtain analytical equations

which describe the influence of these factors on the value of the equilibrium constant. Suitable correlation methods are found for predicting how the Beta factors will vary in series of analogous compounds. Recommendations are given for the choice of isotope separation systems. An attempt is made to extend some of the resulting conclusions to isotope exchange in polyatomic compounds. (Author abstract)

7026 APTIC NUMBER 15266

Rozenberg, Jean
PHOTOCHEMICAL SEPARATION OF ISOTOPES. Isotop. Radiat. Technol., 3(3):200-205, Spring 1966. 57 refs.

Experiments in the photochemical separation of isotopes are reviewed, and the technique is shown to be especially applicable to mercury isotopes. Good separation requires that the bands in the absorption spectrum of the element be widely separated and that the product enriched by photoselective reaction not be contaminated by secondary reactions. Separation of mercury isotopes is a well-developed procedure and is about to become industrial. Lithium isotopes should theoretically be separable by such a technique, but handling of molten lithium is difficult. The failure of the first attempts to separate chlorine and uranium isotopes is probably due to misjudgment of the primary mechanisms and to the use of too simple techniques. Hydrogen isotopes may be separated with light sources with H (or D) alpha Lyman sources, but yields are too low for large-scale use. (Author abstra modified)

7027 APTIC NUMBER 14624

Rozlovskiy, A. I. and Ye. P. Rodin
HIGH-TEMPERATURE CHILLING OF NITROGEN OXIDES. (Vysokotemperaturnaya zakalka okisi azota). Text in Russian. Doklady Akad. Nauk SSSR, 177(2):397-400, 1967. 9 refs.

This thermodynamic analysis of nitrogen oxidation, based on the literature, is directed toward an understanding of the effects of 'chilling' of the reaction products at high temperatures. Cooling rate as a function of temperature is plotted over the range 1900-4200 K for an equimolar N2-O2 mixture at 1 atm for an NO concentration of 15%. Nitrogen oxide losses during chilling are tabulated for temperatures ranging from 2663 to 4000 K at pressures of 0.77, 1, and 10 atm, with an O2-N2 ratio of 1:1, 1:4, or 1:10, and chilling rates ranging from 20,000 to 100,000,000 deg/sec.

7028 APTIC NUMBER 15830

Ruckenstein, E. and O. Smigelschi
THE THERMAL THEORY AND THE PLATE EFFICIENTY. Can. J. Chem. Eng., 45(6):338-340, Dec. 1967. 19 refs.

Experimental and theoretical studies of distillation-column plate efficiency are reported. The dependence of plate efficiency on composition was studied in experiments with methanol-water and cyclohexane-toluene mixtures in bubbling and foam regimes. The methanol-water system was chosen because its boiling-point surface tension is strongly dependent on concentration, the cyclohexane-toluene system because its surface tension is practically independent of concentration. For both systems, the same form of plate efficiency vs composition curves were obtained. These curves show a weak maximum, suggesting that plate efficiency is dependent on composition. Since the Marangoni effect does not occur in the system, the thermal effect is the only possible explanation for the maximum in the cyclohexane-toluene system. The efficiency curve maximum of the methanol-water system in the bubbling regime is also believed to be explained primarily by the thermal effect, though the Marangoni effect may be of some importance. In the methanol water foaming regime, the Marangoni effect probably exerts an important influence on contact surface areas. Among the equations proposed to explain the rectification process, one is based on the diffusional model derived from classical theory. It adequately predicts the plate efficiency curve up to the maximum, even though the classical theory is not able to explain the existence of the maximum. Equations derived from the thermal theory are in closer agreement with experimental results and predict the existence of the maximum. At the present time, equations cannot be written which take into account the Marangoni effect.

7029 APTIC NUMBER 14372

Ruff, Otto and Gerhard Roesner
ADSORPTION ON SOLID BOUNDARY SURFACES. I.: NEW DETERMINATIONS OF ADSORPTION OF GASES ON DIFFERENT ACTIVATED AND NON-ACTIVATED CHARCOALS. (Adsorption an festen Grenzflaechen. I.: Neue Bestimmungen der Adsorption von Gasen an verschiedenen aktivierten und nicht-aktivierten Kohlen). Text in German. Chem. Ber., vol. 60:411-425, 1927. 31 refs.

The question of how molecular dispersed dissolved substances influence adsorption was studied in detail with a number of activated and non-activated charcoals, such as coconut charcoal, acetylene-soot charcoal, (both activated and non-activated), activated commercial charcoal and non-activated and activated supranorite. Argon, CO2, NH3, and SO2 were used as sample gases. After careful drying, the coal was weighed and heated to 400 C until all residues of adsorbed air had disappeared. The results of the measurements showed no connection between the adsorption capacities for dissolved and for gaseous substances. The capacity to adsorb gas seemed to be less dependent on the activity than on the structure of the charcoal. The structural factor with the greatest influence appeared to be the so-called 'atom gap', which might be due to absence of individual atoms or entire atom complexes. Larger-sized charcoals generally had a better adsorption capacity than small-sized ones. If activated charcoals are heated in a vacuum or in an indifferent gas atmosphere to 1100 C, the activity and adsorption both decrease. Determination of the adsorption isotherms of a number of activated and non-activated charcoals using Ar as the adsorbing gas showed that non-activated charcoals also have a gas adsorption capacity. The adsorption capacity is independent of activity.

7030 APTIC NUMBER 15048

Ruhemann, M. and P. L. Charlesworth
THE THERMODYNAMIC EFFICIENCY OF GAS SEPARATION PLANTS. Brit. Chem. Eng., 11(8):839-842, Aug. 1966. 2 refs.

The sources of inefficiency in gas separation units are analyzed. Variations in column pressure accompanied by other modifications can affect thermodynamic efficiency. However, the principal causes of low thermodynamic efficiency are difficulty of cold recovery and the irreversibility of the distillation columns. This is due to the large temperature differences between the top and bottom ends of columns fractionating the multicomponent mixtures encountered in low temperature hydrocarbon separations. To improve efficiency and reduce the utility consumption of hydrocarbon gas separation plants, a higher degree of cold recovery should be achieved wherever possible. Temperature differences between the ends of the columns should be decreased. The circulation rate of refrigerants should be reduced as far as possible. The amount of the higher boiling refrigerant which must be compressed to a sufficiently high pressure to allow it to be condensed against cooling water should be minimized. The steps to improve thermodynamic efficiency in two of a different design plants, one high pressure, the other low pressure, are described. Although the efficiency of the high pressure plant is considerably greater than that of previous variants, power consumption is still high. This is partly due to the fact that the ethylene product is made available at an elevated pressured and that a portion of it is supplied as liquid. The power consumption of the low pressure plant is considerably lower than the high pressure plant. Other features of the two plant designs will have to be compared from both practical and economic viewpoints before a design preference is made.

7031 APTIC NUMBER 14569

Rumyantsev, Yu. V. and D. M. Chizhikov
REACTION OF METALLIC NICKEL WITH SULFUR DIOXIDE. (O vzaimodeystvii metallicheskogo nikelya s sernistym gazom). Text in Russian. Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, no. 10:147-151, 1955. 2 refs.

A study of the reversible reaction 7Ni plus 2SO2 yields Ni3S2 plus 4NiO is reported. Vigorous reaction was found to begin in the range 460-470 C, maximum reaction rate occurring between 600 and 800 C with reduced rates at higher temperatures. Intermediate and basic sulfates may form through intermediate reactions, retarding the reaction, but they are unstable and dissociate during the course of the reaction and at elevated temperatures. Reversible reaction between Ni3O2 and NiO is possible above 800 C. The equilibrium pressure of SO2 is low, ranging from 60 to 70 mm Hg at practical calcination temperatures (800-1200 C). The empirical value for reaction rate in mm/min as a function of temperature (T) is given as 0.9969 times ten to the minus 21st power times T to the 7.05th power. The backward reaction may be achieved at 1100-1200 C only by removing SO2 from the reaction vessel.

7032 APTIC NUMBER 13594

Russell, Norman A.
THE INITIAL PHASE OF THE AQUEOUS CHLORINATION OF KRAFT PULP MEALS. TAPPI, 49(9):418-422, Sept. 1966. 20 refs. (Presented at the 51st Annual Meeting, Technical Assoc. of the Pulp and Paper Industry, New York, N. Y., Feb. 20-24, 1966.)

A tubular flow reactor was designed to investigate the rapid, initial phase of aqueous chlorination of kraft pulp. A substantial portion of the total chlorine consumption and lignin removal occurs in this reaction stage. The pulps used in the study were ground in a Wiley mill to promote intimate mixing in the reactor. Duplicate chlorination experiments demonstrated the utility of the reactor system in obtaining reliable data for reaction durations of less than 43 sec. Delignification in the initial phase of chlorination was quite sensitive to the presence of molecular chlorine. Changes in pH or available chlorine concentration which increased the concentration of molecular chlorine promoted delignification and yielded higher levels of organically bound chlorine in the pulp meals. A definite relationship between delignification and the extent of bound chlorine was observed for all reaction conditions. Oxidative consumption of chlorine contributed to lignin removal to an extent dependent upon the temperature and concentration of molecular chlorine. A maximum of about 1 g of chlorine was consumed per gram of lignin removed. Cellulose degradation, as indicated by pulp viscosity, was slight except at low reaction ph where acid attack also contributed to the overall viscosity loss. Many of the observations made during the short reaction periods used in this study were similar to results of previous studies of pulp chlorinations which proceeded from several minutes to several hours. (Author abstract modified)

7033 APTIC NUMBER 15089

Rutherford, William
ISOTOPE SEPARATION PROCESS RELIES ON TIGHT CONTROL OF LEAKAGES. Chem. Eng., 74(15):176-178, July 17, 1967.

The first continuous system for separating and enriching carbon-13 to more than 90% enrichment is in operation at the Atomic Energy Commission's (AEC) Mound Laboratory in Miamisburg, Ohio. The process uses 12 thermal-diffusion columns of both hot-wire and concentric-tube design, grouped in a series-parallel combination called a cascade pattern, to obtain elemental carbon-13 from commercial methane feed of ultra-high purity. The heart of the process is the thermal-diffusion column, where the light component of the methane-e.g., C(12)H4-is carried upward by virtue of a laminar convection current, and the heavy isotope, C(13)H4 is carried downward by a similar, descending current. The separation, by thermal diffusion, proceeds on a horizontal plane inside the column, as the incoming methane is faced with a hot surface and an opposing cold surface. The plant obtains about 1 g/mo of carbon-13 by raising the feed's natural isotope concentration of 1.1% to 95% in the end product. The isotope is offered either as elemental carbon-13 or as isotope-rich barium

carbonate made by burning methane in excess oxygen; the resulting carbon dioxide is absorbed in barium hydroxide. Part of this CO2 stream is converted into elemental carbon by reacting it with hydrogen over an iron catalyst at 550 C. The carbon is purified by removing the iron with hydrogen chloride at 1000 C. Thermal diffusion was chosen over other isotope separation methods because of its comparative simplicity and equipment reliability. A flow diagram of the process is given, and some of the design problems are briefly discussed. These include the rate of methane decomposition at different temperatures, over-all plant leakage, the long start-up period necessary before production can begin, a low productivity rate, and control of impurities.

7034 APTIC NUMBER 15970

Ryden, L. L. and C. S. Marvel
POLYSULFONES FROM ACETYLENES AND SULFUR DIOXIDE. J. Am. Chem. Soc., Vol. 58:2047-2050, Oct. 1936. 7 refs.

In investigations of the reaction of sulfur dioxide with a variety of substituted acetylenes, monosubstituted acetylenic hydrocarbons were found to combine with sulfur dioxide to give polymeric products. Both monoalkylacetylenes with an alkyl group containing one to five carbon atoms and phenylacetylene combined readily with sulfur dioxide in the presence of alcohol and peroxide-containing paraldehydes. Disubstituted acetylenes did not give this addition reaction. The products of the addition of sulfur dioxide to the monosubstituted acetylenes are presumably polysulfones containing one double bond for each hydrocarbon residue in the polymer. The addition of sulfur dioxide is to the acetylene and not an allene. The polymers are readily hydrolyzed. Among the phenylacetylnepolysulfone derivatives are benzylmethylsufone, acetophenone, benzoic acid, and sodium sulfite. Hydrolysis of 1-pentynepolysulfone gave a trace of methyl n-propyl ketone. About 40-50% of the sulfur was removed as sulfur dioxide. The only other hydrolysis product isolated was C10H16SO2. Pyrolysis in boiling dioxane removed half the sulfur from 1-heptenepolysulfone as sulfur dioxide. Phenylacetylenepolysulfone was insoluble in dioxane, but 62-73% of the sulfur was liberated as sulfur dioxide after heating the polymer. Though evidence is still too meager to ascribe definite formulas to acetylene-sulfur dioxide polymers, there is apparently considerable difference between alkyl substituted and aryl substituted products.

7035 APTIC NUMBER 16083

Ryden, L. L. and C. S. Marvel
THE REACTION BETWEEN SULFUR DIOXIDE AND OLEFINS. III. HIGHER OLEFINS AND SOME LIMITATIONS OF THE REACTION. J. Am. Chem. Soc., vol. 57:2311-2314, Nov. 1935. 18 refs.

The formation of polysulfones from sulfur dioxide and a variety of unsaturated compounds was studied. Polysulfones were obtained by the combination of sulfur dioxide and methylpropene, 1-pentene, 2-pentene, 1-nonene, 3-cyclohexylpropene, and 3-methylcyclohexane. No reaction was obtained between sulfur dioxide and trimethylethylene, tetramethylethylene, pinene, or 1,4-dihydronaphthalene. The failure of these olefins to react with sulfur dioxide indicate that increasing the number of hydrocarbon substituents on the carbon atoms that are attached by a double union will tend to block the addition reaction. Sulfur dioxide was also treated with 1-chloropropene, trichloroethylene, allyl cyanide, 2-allyl-p-cresol, undecylenic acid, sodium undecylenate, ethyl undecylenate, ethyl erucate, crotonaldehyde, oleyl alcohol, and undecylenyl alcohol. Only undecylenyl alcohol gave a polysulfone. This conforms the observation that an alcoholic hydroxyl group in the olefin molecule does not interfere with the formation of a polysulfone. The failure of oleyl alcohol to combine with sulfur dioxide must be due to the fact that the double bond is in the middle of a long chain. The polysulfones described are probably of the alcohol type, as none of them were alkali soluble, and those which were treated with an acid chloride gave acyl derivatives. It was probable that the polysulfones derived from olefins of the type RCH double bond CH2 are closely related to propylenepolysulfone in structure.

7036 APTIC NUMBER 15944

Rylands, J. R. and J. R. Jenkinson
THE ACID DEW-POINT. Eng. Boiler House Rev., vol. 69:104-111, 1954. 14 refs. (Presented at a meeting of the Inst. of Fuel, London, March 4, 1954.)

The mechanism of deposit formation on heat-exchange surfaces of sulfuric acid at elevated temperatures is considered in terms of acid dew point temperatures and the reliability of instruments for estimating the acid dew point. Also discussed is the new concept that the rate of condensation of sulfuric acid, as distinct from dew point temperatures, depends on the amount of acid in the gas. To resolve arguments concerning the form in which acid is condensed, acid dew formation was studied by volumetric techniques not dependent on electrical measurements. Tests demonstrated the presence of two distinct dew points: acid and water. Results show that while there may be a theoretical dew point temperature as defined on a saturation basis, there is no precise dew point temperature as defined on a condensation basis: properties of the adsorption layer shaded insensibility into those of the liquid layer of the condensate. Other experiments were directed toward the role of water vapor in the condensation mechanism. They show that water vapor fixes concentrations of the condensate and hence the overlying SO3 partial pressures. A corresponding rise in acid dew point temperatures indicates that a variation in the water content affects the acid dew point. Maximum acid deposition for most acid concentrations in boiler practice occur at 220 to 280 F. Above this range, acid exists in an unsaturated state; below it, the acid combines with water vapor to form a mist. The supersaturation phenomena can be suppressed by shock cooling gaseous mixtures with lower acid concentrations at a location slightly before the approximate dew point position.

7037 APTIC NUMBER 15958

Rylek, M. and G. Standarc
THE HYDRAULICS OF SIEVE TRAYS. Int. Chem. Eng., 4(4):711-747, Oct. 1964. 130 refs.

An extensive survey is offered of the published literature on the hydraulics of distillation-column sieve trays with downcomers. The references are grouped according to major hydraulic problem areas: technical analysis of given tray types; operating characteristics of trays with and without downcomers; pressure drop for dry trays; liquid hold-up on a tray; hydraulics of wetting trays; and liquid layer expansion. A comparison of proposed solutions for each problem shows the extent to which equations of individual authors differ and calculations methods vary. A common feature of the studies is a total lack of direct published experimental data, making it impossible to verify individual equations and calculation methods. The present state of knowledge is satisfactory for the problem of pressure drop on dry trays, but very unsatisfactory for hold-up of liquid on a tray as a function of gas and liquid flow rates, the beginning of hold-up on a tray, and expansion of the liquid layer on a tray. It is concluded that because of the lack of design data and the great differences in conditions under which distillation columns are operated, it is impossible to make a suitable tray selection for a given purpose.

7038 APTIC NUMBER 16377

Rzayev, P. B., V. A. Roytb-, and G. P. Korneychuk
KINETICS OF SULFURIC ACID CATALISIS ON BARIUM-ALUMINUM-VANADIUM CATALYSTS. (O kinetike sernokislotnogo kataliza na bariyevo-alyr.ovanadiyevykh katalizatorakh). Text in Russian. Ukr. Khim. Zh., 26(2):161-167, 1960. 5 refs.

The kinetics of sulfur dioxide oxidation on barium-aluminum-vanadium catalysts were studied and found to conform to an equation derived elsewhere by G. K. Boreskov. The heat of activation was 23 kcal/mole and pertained to an internal-kinetic regime which was not distorted by the effect of macrofactors. Even with small catalyst grains (1.5-2.0 mm diameter), conversion factors below 70%, and temperatures above 500 C, an internal diffusion retardation occurred which reduced the measured heat of activation. The activity of the catalyst remained practically constant with significant differences in the degree of reduction of vanadium oxides in the catalyst. Possible causes for overestimation of the heat of activation by the diaphragm method were discussed.

7039 APTIC NUMBER 14635

Safiullin, M. Sh. and A. M. Tseytlin
ABSORPTION OF NITROGEN OXIDES BY SULFURIC ACID. (Absorbtsiya okislov azota sernoy kislotoy). Text in Russian. Zh. Prikl. Khim., vol. 36:490-495, 1963. 15 refs.

Studies made with gases containing 0.15-0.20% NO-NO2 showed that the absorption of nitrogen oxides increases with an increase in sulfuric acid concentration up to 85%, but that further increase in concentration has no significant effect on absorption rate. Increasing the linear rate of the gas above 0.5 m/sec and the reflux density above 6-7 cu m/sq m-hr has no noticeable effect on the rate or completeness of absorption. As the N2O3 content of the sulfuric acid increases (from 0 to 4.4% HNO3), the absorption rate of nitrogen oxides decreases by 8%. The absorption rate is significantly affected by the process temperature; relative absorption rates at 18, 40, and 60 C are 1, 0.48 and 0.38, respectively.

7040 APTIC NUMBER 15134

Salama, C. and D. V. Eyre
MULTIPLE REFRIGERANTS IN NATURAL GAS LIQUEFACTION. Chem. Eng. Progr., 63(6):62-67, June 1967.

Three types of cascade cycles for liquefying natural gas in large-capacity plants are described. A standard cascade cycle which consists of a succession of refrigeration cycles and utilizes propane, ethylene, and methane refrigerants in closed loops, has certain high-cost and complex operational drawbacks. The dual-refrigerant cycle represents a simplication of the standard cycle by combining the ethylene and methane refrigerant cycles into one group. The development of the autorefrigerated cascade (ARC) cycle was a further refinement of the liquefaction process. The principle of this cycle is still one of refrigeration transfer from cooling water to decreasing temperature levels, as with the other cycles, but the refrigerant consists of a single mixture having a composition which allows the partial condensation at any one state to correspond exactly to the refrigeration requirements of the next stage. The partial condensations of the refrigerant take place at one pressure level corresponding to the high pressure of the cycle, while the vaporizations occur at a single low pressure corresponding to the cycle compressor suction pressure. The refrigerant used in the process is a mixture of nitrogen and hydrocarbons. Flowsheets and detailed descriptions of each of the cycles are presented, as well as a discussion of the thermodynamics involved. The advantages of the ARC cycles over the others favor its application whenever multiple-refrigerant cycles are considered for the liquefaction of natural gas. These advantages include low over-all investment, flexibility of operation, efficient use of installed horsepower, ease of maintenance, no requirement for the purchase of costly high-purity refrigerants, and constant availability of the total amount of refrigeration in different sections of the cycle.

7041 APTIC NUMBER 14381

Samedov, M. A. and P. F. Rza-Zade
INVESTIGATION OF THE CHEMISTRY OF MOLYBDENUM. COMMUNICATION 2. STUDY OF THE SIDE AND INTERMEDIATE REACTIONS OF MOLYBDENUM DISULFIDE WITH CARBON DIOXIDE GAS. (Issledovaniye v oblasti khimii molibdena. Soobshcheniye 2. Izucheniye pobochnykh i promezhutochnykh reaktsiy disul'fida molibdena s uglekislym gazom). Text in Russian. Tr. Inst. Khim. Acad. Nauk, Azerb. SSR, vol. 13:21-27, 1954. 5 refs.

It was established that MoS2 on heating enters into a reaction with SO2 with the formation of MoO2 and free sulfur according to the equation MoS2 plus SO2 yields MoO2 plus 3S. The course of this reaction is initiated at a temperature of 800 deg and is

increased with an increase in temperature; completion of the process is attained at 1100 deg. Action of SO2 on MoS2 can be regarded as a new method for obtaining MoO2. The reaction occurring between SO2 and MoS2 can take place either by roasting molybdenum or by interaction of MoS2 with CO2. Molybdenum disulfide is not significantly changed by the action of CO even at 1000 deg; this distinguishes it from the sulfides of other metals and is explained by the comparatively great stability of the sulfur-molybdenum bond. The presence of CO by virtue of its reducing action interferes with the reaction between MoS2 and SO2. On heating, SO2 acts on metallic molybdenum according to the equations: Mo plus SO2 yields MoO2 plus S; 2S plus Mo yields MoS2; and MoS2 plus SO2 yields MoO2 plus 3S. Molybdenum oxide within temperature limits of 400-1000 deg enters into a normal reaction with SO2.

7042

APTIC NUMBER 15030

Sandler, Stanley I. and John S. Dahler
KINETIC THEORY OF LOADED SPHERES. II. J. Chem. Phys., 43(5): 1750-1759, Sept. 1, 1965. 3 refs.

The Chapman-Enskog method of solution is applied to the Boltzmann equation for a dilute gas of loaded spheres. It is shown that the anistropy of the molecular spin distribution has almost no effect upon the numerical values for the thermal conductivity and viscosity. The numerical differences between the coefficients calculated from the anistropic Kagan-Afanas'ev distribution and those from the isotropic Pidduck function are of the same order of magnitude as the differences between the usual first and second approximations of Chapman and Enskog. The present calculations tended to confirm the expectation that because the collisions of rough spheres are so extremely elastic, the model might provide upper limits to the effects of spin anistropy. On the basis of the results, it is expected that anistropy will be of little importance in real polyatomic gases.

7043

APTIC NUMBER [illegible]968

Sastri, M. N. and T. P. Prasad
THERMAL DECOMPOSITION OF BERYLLIUM SULPHATE TETRAHYDRATE. J. Inorg. Nucl. Chem., 30(6):1639-1640, July 1968. 8 refs.

The pyrolitic behavior of [illegible]ium sulfate tetrahydrate was studied. Beryllium sulfat[illegible] ahydrate was dried to a constant weight in a vacuum over a [illegible] gel. About 250 mg was used for the thermogravimetric study. [illegible] thermobalance with a sensitivity of 1 mg, linear heating of 4 C/min, and a chart speed of 6 in./hr was used. The differential graph was drawn by plotting the weight loss/5 min against the temperature. The differential curve shows that the loss of water begins at 85 C with a maximum rate at 150 C. The weight loss between 85 and 200 C corresponded to 3.5 H2O. Between 200 and 300 C, the weight change was irregular and the total weight loss in that region was equivalent to 0.5 H2O. The anhydrous sulfate was stable between 330 and 600 C, and this was converted completely to the oxide at 850 C. The thermogram did not indicate the existence of any intermediate hydrate except perhaps an unstable hemihydrate in the 200-300 C region. No change in weight was indicated in the region where the anhydrous sulfate was present which was in contrast to the observation of Duval and Duval that the line was not absolutely horizontal. Further, conversion to the oxide was complete at 880 C as against 1031 C reported by them.

7044

APTIC NUMBER 14549

Sato, K. and T. Akihata
ADSORPTION WITH POROUS SUBSTANCES. (Takosei busshitsu ni yoru kyuchaku ni kansuru kenkyu). Text in Japanese. Kogyo Kagaku Zasshi (J. Chem. Soc. Japan), 60(2):142-144, Feb. 1957. 10 refs.

The velocity of the adsorbate particle during adsorption is determined by the following three factors: the velocity of particle distribution within the membrane which covers the adsorbent surface; the distribution velocity of the adsorbate particle within the adsorbent; and the distribution velocity of the adsorbate particle on the surface of the adsorbent. The last factor is the most important, and the adsorption velocity at any given place within an adsorbent at any given time can be calculated. The adsorbent is assumed to be a globular particle according to the Wicke model, which contains multiple micro- and macro-pores within the particle having a large surface area for adsorption. The particles are tightly packed within a cylindrical tower maintained at a stable temperature. The flow of the adsorbate particles is kept constant at a cross section of the tower. The formulae discussed for such conditions may be adapted for use with ion-exchange resins.

7045

APTIC NUMBER 16207

Schiemann G., F. Fetting, G. Prauser, and F. Steinbach
HETEROGENEOUS REACTIONS IN A FREE FALL REACTOR. (Heterogene Reaktionen in einem Rieselwolkenreaktor). Text in German. Inst. Chem. Engrs. Symp. Ser., no. 27:153-160, 1968. 12 refs.

The reaction mechanism in a free fall reactor was studied and compared with the ideal flow tube and the ideal agitator vessel. The hydrogenation of ethylene and the oxidation of carbon monoxide on grained Pd-containing catalysts were used as model reactions. The kinetic data of these reactions were determined in a fixed-bed reactor connected in parallel to the free fall reactor. The speed of the hydrogenation process was determined by the substance transport, that of oxidation by the chemical reaction speed. To interpret measurements of the amount of substance converted, mixing processes were studied using a dispersion model. The Bodenstein numbers obtained from the measured mixing coefficients were used to calculate the quantity converted. The measured values agreed well with the calculated values.

7046

APTIC NUMBER 16411

Schuftan, P. M.
RECENT ADVANCES IN AIR SEPARATION. Chem. Process. Eng., 45(10): 545-548, Oct. 1964. 20 refs.

Recent advances in the low-temperature separation of air are summarized with reference to plant capacities and cycles, plant components, product storage and distribution, safety factors, and applications. The cycles used to produce tonnage oxygen are mainly the Linde-Fraenkl cycle, which operates at atmospheric pressure, and cycles which produce oxygen directly under pressure by internal compression of liquid oxygen in a pump and subsequent vaporization. To produce ratios of pure nitrogen to oxygen of up to 3:2, the Claude cycle is suitable; the Heylandt cycle is preferred to produce liquid oxygen. Physical processes for carbon dioxide removal are under development, and methods for producing pure nitrogen, high-purity argon, and krypton are noted. Design factors related to components of air-separation plants are discussed; these components include turbo-compressors; regenerators for heat exchange and primary purification of low-pressure air; reversing exchangers; weight and insulation of air separation units; and trays involved in the rectification system. The design of gas storage tanks and pipeline and rail distribution systems is described. Plant safety requires that the presence of oxygen in concentrations of about 25% must be avoided, together with combustible materials which, in air separation units, are hydrocarbons from the atmosphere or lubricating oils. Oxygen finds its major application in steelmaking, in chemical industries and in rocketry; a big potential field is the enrichment of blast furnace air. Demand for gaseous nitrogen, in the petrochemical, steel, electronic and glass industries, and for liquid nitrogen as a coolant, are rapidly increasing, as is the demand for argon for use in arc welding and in the production of electronic tubes, titanium, and electric or flash bulbs.

7047 APTIC NUMBER 16040

Seyer, W. F. and Eric Todd
CRITICAL SOLUTION TEMPERATURES OF SYSTEMS OF SULFUR DIOXIDE AND NORMAL PARAFFINS. Ind. Eng. Chem., vol. 23:325-327, March 1931. 7 refs.

The conditions under which paraffin hydrocarbons (butane, hexane, octane, decane, tetradecane, dodecane, and dotriacontane) are insoluble in liquid sulfur dioxide were investigated. The temperatures defining the limits of miscibility were plotted against both the number of grams of sulfur dioxide in 100 grams of mixture and against the mols of sulfur dioxide in 100 mols of mixture. The curves obtained by plotting miscible temperature against the mol fraction times 100 of the sulfur dioxide were distorted to the right, since the molecular weight of the hydrocarbons were higher than that of sulfur dioxide. Symmetrical curves were obtained when the miscible temperatures were plotted against percent by weight of the sulfur dioxide. The similarity of curves with only one consolute temperature was unwarranted: surface tension measurements indicated that the association is nil or negligible in both hydrocarbons and sulfur dioxide. However, the curves indicate that below the critical solution temperature the solubility of sulfur dioxide in the hydrocarbon is greater at the same temperature than the solubility of the hydrocarbon in the sulfur dioxide. The curve of molecular weight of hydrocarbons vs critical solution temperature indicates that molecular weight is a factor in determining the critical solution temperature point; it must be considered in any attempt to deduce a general equation defining miscibility limits in a binary system. It is also shown that the amount of hydrocarbon soluble in sulfur dioxide at its boiling point is comparatively small.

7048 APTIC NUMBER 16054

Seyer, W. F., K. Martin, and L. Hodnett
SYSTEMS OF SULFUR DIOXIDE AND THE ISOMERIC XYLENES. J. Am. Chem. Soc., vol. 59:362-363, 1937. 1 ref.

A series of freezing-point measurements were taken on systems of sulfur dioxide and ortho-xylene, sulfur dioxide and para-xylene, and sulfur dioxide and meta-xylene. The bulb method was used to determine the freezing points. The freezing-point curves of the three systems were constructed from the data. Each system has only one eutectic; apparently, there is no compound formation. The latent heats of fusion were calculated and compared with experimental values. Of the systems studied, only the o-xylene and sulfur dioxide solution behaved very nearly as ideal solution. The p-xylene system deviated positively and the m-xylene system deviated negatively from the ideal solution.

7049 APTIC NUMBER 15128

Shaffer, Bernard W.
MATERIAL PROPERTIES OF REINFORCED PLASTICS. SPE(Soc. Plastic Engrs.) Trans., 4(4):267-276, Oct. 1964. 3 refs.

General expressions are derived which relate the material properties of filament-reinforced plastics in an arbitrary direction with their material properties in the direction of elastic symmetry. For a complete description of the material properties of reinforced plastics, it is necessary only to prescribe the moduli of elasticity, the shear modulus, and the Poisson ratio. Though the variation of moduli of elasticity with filament angle is calculated for a two-dimensional problem, the results may be applied to the analysis of three-dimensional problems, provided all filaments lie in planes perpendicular to one of the coordinate axes.

7050 APTIC NUMBER 13998

Shaffer, J. H., W. R. Grimes, and G. M. Watson
SOLUBILITY OF HYDROGEN FLUORIDE IN MOLTEN FLUORIDES. I. IN MIXTURES OF NaF-ZrF4. J. Phys. Chem., 63(12):1999-2002, Dec. 1959. 25 refs.

Because of their value in nuclear fuel element reprocessing and their use as fuel for experimental nuclear reactors, mixtures of NaF and ZrF4 were chosen to investigate the solubilities of hydrogen fluoride at pressures from 0.5 to 3 atm and from 550 to 800 deg. The solubility of HF in all mixtures studied follows Henry's law and, in contrast to the behavior of noble gases in similar solvents, decreases with increasing temperature. As the mole percent of NaF in the solvent is increased from 45 to 80.5,

solubility increases approximately tenfold. The enthalpy of solution, like the solubility, is dependent on the solvent composition. The values of entropies of solution are all negative and change only 1 e. u. over the range of solvent compositions investigated. The observed strong dependence of HF solubility on solvent composition may be related to the relatively high stability of NaF-HF compounds.

7051 APTIC NUMBER 16432

Shams El Din, A. M. and A. A. A. Gerges
ON POTENTIOMETRIC ACID-BASE TITRATIONS IN MOLTEN SALTS-II. THE TITRATION OF NAH2PO4, NA2HPO4, NAPO3 AND NA4P2O7 WITH NA2O2 IN MOLTEN KNO3. Electrochim. Acta, vol. 9:125-131, 1964. 6 refs.

The four acids NaH2PO4, Na2HPO4, NaPO3, and Na4P2O7 were titrated potentiometrically with Na2O2 in molten KNO3 at 350 C. An oxygen electrode acted as indicator electrode, while an Ag/Ag(I) electrode served as a reference electrode. Sodium dihydrogen phosphate neutralized in two steps, the second of which was identical with that for the neutralization of Na2HPO4. The system PO3(-) + O(2-) in equilibrium with PO4(3-) does not represent an acid-base equilibrium, as is generally claimed. During titration, NaPO3 changed to Na4P2O7 and then to Na3PO4. The acids were determined with an average percentage area of plus or minus 2%. Mixtures of NaH2PO4 + Na2HPO4 and NaPO5 + Na4P2O7 were similarly titrated with reasonable accuracy. The titration results are discussed theoretically and relative equilibrium constants are calculated. Comparison is made between the results obtained in fused and aqueous media. The titration of phosphoric acid solutions shows two distinct steps corresponding to the formation of mono- and disodium salts respectively. The ionization of the third hydrogen ion in aqueous solutions is too small to give a distinct inflexion in the titration curves. In the molten state, phosphoric acid anhydride is an extremely strong acid which attacks the nitrate base with the evolution of nitric oxide fumes. The second and third hydrogen ions are easily ionized, and the ionization of the third hydrogen ion is much stronger than in aqueous solutions. In the molten nitrate, the metaphosphate changes to the pyrophosphate and the latter to the trisodium phosphate. These transformations do not occur in aqueous solutions. (Author abstract modified)

7052 APTIC NUMBER 14746

Shams El Din, A. M. and A. A. El Hosary
ON THE FORMATION OF PYRONITRATE IN MOLTEN SALTS. Electrochim. Acta, 12(12):1665-1675, 1967. 17 refs.

Experiments describing the reaction between N2O5 and O(2-) and the conditions for the formation of the pyronitrate anion are reported. Nitric anhydride reacts with O(2-) ion in LiCl-KCl eutectic mixture at 450 C to give NO3(-) which can be considered as metanitrate and is expected to form the corresponding pyro- salt under appropriate conditions. The O(2-) ion in LiCl-KCl melt is potentiometrically titrated with KNO3. The titration curves show an inflection at the composition corresponding to pyronitrate. The formation of pyronitrate in KNO3 melts was also established. Strong oxide ion donors react slowly with the melt to produce a compound of less basic character. The reaction is zero-order with respect to O(2-). Pyronitrate in molten KNO3 possesses a basicity comparable to that of the carbonate ion in the same melt. It readily lends its oxide ion to strong acids. X-Ray diffraction patterns of NO3(-)pyronitrate mixtures showed peaks that can be correlated with the new anion. (Author abstract modified)

7053 APTIC NUMBER 16433

Shams El Din, A. M. and A. A. A. Gerges
POTENTIOMETRIC ACID-BASE TITRATIONS IN MOLTEN SALTS-III. THE USE OF A METAL/METAL-OXIDE ELECTRODE AS AN INDICATOR ELECTRODE AND THE DETERMINATION OF ACID-BASE EQUILIBRIA IN FUSED KNO3. Electrochim. Acta, vol. 9:613-627, 1964. 26 refs.

The feasibility of the Cu/CuO electrode for O(2-)-ion determination and for acid-base titration in molten KNO3 at 350 C was established. The potential of the electrode varies linearly with the logarithm of the oxide-ion concentration and the slope of the calibration curve is 2.303 (RT/2F) at the working temperature. This enables determination of the normal Cu/CuO/O(2-) potential. The CuO electrode is used for titrating the acid K2Cr2O7 with Na2O4 in molten KNO3. Sharp potential drops are recorded at the equivalance points. The equilibrium constant of the reaction Cr2O7(2-) + O(2-) equals 2CrO4(3-) is calculated as approximately 1.8 times 10 to the 12th power. Acid-base equilibria constants, computed from the standard O1/O(2-) potential and potentiometric titration curves obtained previously with an oxygen electrode, are presented for a number of acid-base reactions with KNO3. A correlation is drawn between these constants and previously proposed acidity numbers of the same oxy-anions. (Author abstract modified)

7054 APTIC NUMBER 16570

Shames El Din, A. M. and A. A. El Hosary
POTENTIOMETRIC ACID-BASE TITRATIONS IN MOLTEN SALTS. IV. BASIC CHARACTER OF SOME OXIDE-ION DONORS IN MOLTEN KNO3: THEIR REACTION WITH NaPO3 AND K2Cr2O7. Electrochim. Acta, 13(2):135-148, 1968. 22 refs.

The basic character of electrogenerated O(2-), OH(-), O2(2-), HCO3(-), HCOO(-), (COO)2(2-), and CH3COO(-) in fused KNO3 at 350 C was studied by forward and backward potentiometric neutralization experiments with the two acids, NaPO3 and K2Cr2O7. The anions fall into two distinct groups. The first group, the oxide group, is composed of O(2-), OH(-), and O2(2-), which give rise to O2-electrode potentials varying between -850 and -920 mV, and allow the formation of the basic compounds PO4(3-)-O(2-) and 2CrO4(2-)-O(2-). Cyclic neutralization curves suggested the presence of two phosphate glasses, namely, an acid glass nPO3(-)-P2O7(4-), and a basic glass nPO4(3-)-O(2-). The other anions, forming the carbonate, give rise to O2-electrode potentials of about -550 to -600mV, and do not form the basic phosphate or chromate. The thermal decomposition of bicarbonate,

oxalate, formate, and acetate in fused KNO3 was studied in detail. Bicarbonate changes into carbonate. Oxalate produces carbonate and not oxide as previously claimed, together with an equivalent quantity of nitrite. The same occurs also with formate and acetate, but in the latter case, decomposition follows a different route. (Author abstract modified)

7055 APTIC NUMBER 15273

Shapiro, Hymin, Earl George De Witt, and Jerome Engel Brown
ENGINE FUELS WITH THE BOILING POINT OF THE GASOLINE CONTAINING A CYCLIC MANGANESE TRICARBONYL COMPOUND. (Motorentreibstoffe von Benzinsiedebereich mit einem Gehalt an einer zyklischen Mangantricarbonylverbindung). Text in German. (Ethyl Corp., New York) W. German Pat. 1,231,058. 5p., Dec. 22, 1966. (Appl. Nov. 19, 1959, 2 claims).

An additive for fuels of the boiling point range of gasolines contain as antiknock agent a cyclic manganese tricarbonyl compound of the general formula AMn(CO)2. The A stands for a cyclic hydrocarbon residue with 5 to 17 carbon atoms including a C5 group of cyclopentadiene structure. This hydrocarbon residue is bound to manganese with the aid of the carbon cyclopentadiene. The additive is a gasoline soluble compound of an element of the fifth subgroup of the periodic table of elements with the ordinal numbers 15 to 83 at such a quantity that the atom ratio of the added metal to manganese lies between 0.001:1 and 3:1. These additives prevent or at least delay accumulation of large quantities of manganese-containing precipitations between the spark plug electrodes and on the exhaust valves. The concentration of the manganese compounds in engine fuels should preferably range from 0.008 to about 1.585 g/l manganese. To obtain excellent antiknock effects, this concentration should not be exceeded. Antimony is the preferred corrective substance of the fifth subgroup, which contains also phosphorus, arsenic, and bismuth.

7056 APTIC NUMBER 16529

Shapiro, Robert, Robert E. Servis, and Marvin Welcher
REACTIONS OF URACIL AND CYTOSINE DERIVATIVES WITH SODIUM BISULFITE. A SPECIFIC DEAMINATION METHOD. J. Am. Chem. Soc., 92(2):422-424, Jan. 28, 1970. 22 refs.

An important feature of the chemistry of uracil and cytosine is the susceptibility of their ring systems to nucleophilic attack at the 5,6 double bond. It was experimentally determined that sodium bisulfite adds reversibly to the 5,6 double bond of uracil and its nucleosides, and that the favorable equilibrium with this reagent permits their complete conversion under physiological conditions to the dihydrouracil derivatives 3. This reaction is reversed in basic solution. Cytosine derivatives react similarly and are converted by sodium bisulfite to saturated adducts of structure 2. This conversion is analogous to the initial step of reaction of the potent mutagen hydroxylamine with cytosine derivatives. In addition to its synthetic use in nucleotide chemistry, sodium bisulfite should be of value as a reference mutagen. It is the first reagent to be described that can specifically convert one common, naturally occurring nucleic acid heterocycle to another. It is observed that sodium bisulfite is a food additive and sulfur dioxide, an atmospheric pollutant. It seems probable that these substances may constitute a genetic hazard to living organisms.

7057 APTIC NUMBER 16072

Sharma, M. M.
KINETICS OF REACTIONS OF CARBONYL SULPHIDE AND CARBON DIOXIDE WITH AMINES AND CATALYSIS BY BRONSTED BASES OF THE HYDROLYSIS OF COS. Trans. Farady Soc., 61(508):681-688, April 1965. 50 refs.

The kinetics of the reactions between carbonyl sulfide and carbon dioxide with a variety of primary and secondary amines were studied at 25 C in wetted-wall columns, jet apparatus, and stirred cells. The reaction rate constants evaluated from measurements on 1 N amine solutions are tabulated, while the relative rates of reaction of CO2 and COS with amines are plotted as log10kAM-COS against log10kAM-CO2. The plot indicates that the results can be fitted reasonably well to a straight line, suggesting a close, or linear free energy, relationship between the reactions of CO2 and COS with amines. Important factors influencing reaction rates are electrical and entropy effects. All heterocyclic amines investigated exhibit high reaction rates relative to most other amines, presumably due to the absence of steric interference. Pyrrolidine reacts more than six times faster than diethylamine, although the structure of pyrrolidine could be formed from that of diethylamine, although the structure of pyrrolidine could be formed from that of diethylamine with a little distortion. The importance of steric factors is evident: n- and iso-BuNH2 show almost the same reaction rate, but sec-BuNH2 reacts at one-third this rate; tert-BuNH2, where the steric factors are like to be most important, reacts at about a tenth of the rate for n- and iso-BuNH2. Additional experiments in the catalysis by Bronsted bases of the hydrolysis of COS show that general catalytic trends are similar to those found for the hydration of Co2. Rate constants for OH(-) and CH2(OH)O(-), obtained from the absorption of COS i formaldehyde solutions, are 10.1 and 88/mole sec, respectively.

7058 APTIC NUMBER 15459

Shibley, Allen M., Harvey L. Peritt, and Merill Eig
A SURVEY OF FILAMENT WINDING: MATERIALS, DESIGN CRITERIA, MILITARY APPLICATIONS. Plastics Technical Evaluation Center, (Picatinny Arsenal), Dover, N. J., PLASTEC Rept. 10, 251p., May 1962. 169 refs.
PLASTEC 3696

Filament winding is about to evolve as an industry because of its ability to combine great strength with lightness of weight. The filamentary field is surveyed from the military standpoint. Design analysis, raw materials, test methods, and processing techniques are discussed. Rocket motor cases continue to be a major application. Hydrospace vehicles, subjected to high external pressure, offer a future potential. Developments in this direction are underway. In handling design and stress

problems, the netting analysis remains the major tool. It received a number of refinements regarding end closures. With raw materials, greatest emphasis was placed on fiberglass reinforcements. More resin systems are available and being exploited. The use of preimpregnated filaments is more widespread. Test methods, particularly nondestructive testing, present problems. There is also need for improved quality control and a sound basis for standardization. The winding process itself is ready for improvements dealing with patterns, tension control, resin control, curing, and reproducibility. The investigation of suitable mandrel materials and designs is also included. The survey revealed that all major areas of filament winding are being investigated by government agencies.

7059 APTIC NUMBER 16625

Shifrin, K. S. and I. P. Kolmakov
DETERMINATION OF THE SPECTRUM OF PARTICLE SIZES FROM CURRENT AND INTEGRATED VALUES OF THE INDICATRIX IN THE SMALL-ANGLE RANGE. (Vychisleniye spektra razmerov chastits po tekuchim i integral'nym znacheniyam indikatrisy v oblasti malykh uglov). Text in Russian. Fiz. Atm. i Okeana (Moscow), 3(12):1271-1279, 1967. 9 refs.

The small-angle method of spectral analysis using electromagnetic radiation is the most convenient method for determining the microstructure of clouds and fogs, such as spectral transparency, polarization characteristics, and particle-size distribution. Two features are presented of a formula for determining particle size distribution in a polydisperse medium from measured values of its dispersion indicatrix which may give rise to appreciable numerical errors in its applications. One of them, an infinite interval of integration, was previously considered; the other, a differentiation of the experimentally obtained indicatrix, was dispensed with when using either of two alternative formulas for particle-size distribution determinations. The derivation of these formulas is based on obtaining an integral representation of this distribution in terms of an appropriate algebraic function of the indicatrix. In one of the formulas, this function itself, that is, its values computed directly from the measured 'current' values of the indicatrix, is used. In the other, the indefinite integral of this function is used which is equal to zero at the lower limit of integration. The Appendix contains a mathematically rigorous derivation of the results presented in the paper proper, in the light of general properties of Mellin integral transforms, as well as an exposition of certain general properties of the kernels and resolvent kernels of conjugate integral equations of the first kind, which arise in the analysis of inverse problems of atmospheric optics.

7060 APTIC NUMBER 16045

Shiga, Takeshi, Kun-Joo Hwang, and Itrio Tyuma
AN ELECTRON PARAMAGNETIC RESONANCE STUDY OF NITRIC OXIDE HEMOGLOBIN DERIVATIVES. Arch. Biochem. Biophys., 123(1):203-205, Jan. 1968. 11 refs.

The electron paramagnetic resonance (EPR) spectrum of nitric oxide hemoglobin (Hb) derivatives was studied to determine the functional differences in terms of magnetic properties. Measurements were carried out at room temperature or at low temperatures. The EPR spectra of NO-Hb A, NO-Hb alpha, and NO-Hb beta were different from each other. The spectrum of NO-Hb beta was nearly symmetrical. An addition of the spectra for the alpha and beta subunits yielded a spectrum which was almost identical with that for Hb A. The EPR absorption decreased with the increase in temperature without changing the line shapes. The results indicated that the relaxation mechanism and temperature effect are the same in all NO-Hb's. Thus, the line shape differences between alpha and beta chains observed can be related to the altered orbital configuration of heme-NO part in the subunits.

7061 APTIC NUMBER 16046

Shiga, Takeshi, Kun-Joo Hwang, and Itiro Tyuma
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF NITRIC OXIDE HEMOGLOBIN DERIVATIVES. I. HUMAN HEMOGLOBIN SUBUNITS. Biochemistry, 8(1):378-383, Jan. 1969. 22 refs.

To elucidate the molecular conformation of a ligand bound to hemoglobin, nitric oxide derivatives of human adult hemoglobin and its subunits, alpha and beta, were studied by electron paramagnetic resonance spectroscopy. The spectrum of hemoglobin alpha-NO and beta-NO were dissimilar. The spectrum of erythrocytes NO and human adult hemoglobin NO were the arithmetic mean of the spectrum for the isolated subunits. At room temperature, the signal of hemoglobin alpha-NO exhibited axial symmetry, whereas that of hemoglobin beta-NO slightly deviated from axial symmetry. Below -50 deg, however, the signal for both the subunits markedly distorted from axial symmetry. The approximate principal g values were estimated by comparing the observed spectra with simulated spectra calculated by a digital computer. For the simulation, a broad intrinsic line was assumed, which may be due to a freedom of the orientation of NO on heme. The estimated g values for hemoglobin alpha-NO and hemoglobin beta-NO changed with temperature discontinuously. The change in g values was considered to reflect an altered orientation of the NO molecule at room and low temperatures. Urea and high pH removed the steric or libration restriction on the NO molecule in hemoglobin beta-NO, giving a signal of nearly axial symmetry and/or broad intrinsic line width. The effect of temperature and denaturing agents on the signal shape was explained by the change of orientational freedom of liganded NO associated with the conformational change of globin moiety. (Author abstract modified)

7062 APTIC NUMBER 15826

Shumakov, L. G.
INCREASING THE KINETIC ENERGY OF THE BLAST AS A LARGE RESERVE FOR INCREASING PIG-IRON OUTPUT. Steel (USSR) (English translation from Russian of: Stal'), no. 2:176-179, March 1963. 3 refs.

In the Soviet Union, new blast furnaces with large transverse dimensions are subject to hearth choking and uneven gas distribution because the dimensions of the tuyeres and the values of the kinetic energy of the blast were adopted without sound reasons. To improve the permeability of the axial part of the furnace, the kinetic energy of the blast jet must be greater than in small furnaces and, consequently, tuyeres of smaller diameter are required. A formula is given for calculating optimum kinetic energy values and proper tuyere cross-sectional area diameters. Increasing the kinetic energy of the blast should secure normal operation of the new blast furnaces, enabling coke consumption to be reduced, better use to be made of gas energy, and top pressure raised to 2.5-3.0 atm. With respect to coke, the driving rate will be increased to 1.3-1.4 tons cu m/day.

7063 APTIC NUMBER 13719

Siedlewski, J. and S. Trawinski
THE MECHANISM OF CATALYTIC OXIDATION ON ACTIVATED CARBON. THE INFLUENCE OF THE CONCENTRATION OF FREE CARBON RADICALS. Intern. Chem. Eng., 5(2):289-292, April 1965. 8 refs.

The mechanism of the processes taking place on the surface of activated carbon during the catalytic oxidation of H2S and SO2 was investigated. The influence of the concentration of free radicals in the carbon on the adsorption of H2S was studied. All the investigated samples of carbon, regardless of the temperature at which they were prepared, adsorbed the same quantities of H2S at an adsorbate pressure of 760 mm Hg. Carbons containing higher concentrations of free radicals adsorbed considerably more H2S than those with lower concentrations at lower pressures. This indicates that the radical active centers are filled first by the adsorbed substance and are more active than the rest. The number of free radicals on the surface of the carbons did not change as a result of the adsorption of H2S. This indicates that no process connected with the cleavage of the bonds in the adsorbed molecules takes place during the adsorption.

7064 APTIC NUMBER 15776

Slavik, Ivan
ON THE DECOMPOSITION OF SULFUR DIOXIDE UNDER CONDITIONS OF SULFITE COOKING. (Ueber die Zersetzung des Schwefeldioxyds unter Bedingungen der Sulfitkochung). Text in German. Svensk Papperstid. (Stockholm), 64(11):427-437, June 15, 1961. 23 refs.

The decomposition of sulfur dioxide was investigated under conditions corresponding to sulfite cooking. Organic compounds obtained from wood, thiosulfate, polythionate, and elemental sulfur were added. Depending on the amount of sulfuric acid and free sulfur formed, conclusions were drawn as to whether the addition of the compounds had an oxidizing or reducing effect. The dependence of the decomposition on time after the addition of glucose showed the self-catalytic nature of the reaction. At lower temperatures, corresponding to the initial part of the sulfite cooking, formic acid, thiosulfate, and elemental sulfur accelerated the decomposition. Sugar and furfural accelerated the reaction at higher temperatures only. It was established that reducing compounds are primarily responsible for the decomposition acceleration. A stronger effect was observed in buffered solutions than in unbuffered solutions. In unbuffered solutions, a dehydration of glucose occurred with the formation of levulinic acid. Upon the decomposition of SO2, xylose compounds of a sulfonic acid nature were obtained instead of hexose. In unbuffered solutions, xylose and furfural gave condensation products of a sulfonic acid nature. The influence of thiosulfate and tetrathionate were practically the same. In solutions containing SO2, both compounds were found, regardless of which one was added to the solution. When the organic compounds obtained from wood, thiosulfate, polythionate, and elemental sulfur are present in minute quantities in the cooking liquor, they may favorably influence the cooking. But in larger quantities, they contribute to an increase in the chance for lignin condensation, which may result in a black cook.

7065 APTIC NUMBER 15855

Slesser, C. G. M. and J. Highet
TRANSFER UNIT MODEL OF A SLURRIED BED REACTOR. Brit. Chem. Eng., 11(4):247-252, April 1966. 12 refs.

The slurried bed reactor is a system in which reacting gas or gases pass through a column of liquid in which solid catalyst particles are suspended. Factors which affect the performance of the reactor include vapor pressure and solvent recirculation. The liquid medium can have an effect on the partial pressure of the reactants in a reactor with an outlet provision for separation of gas from liquid and a liquid recycle, thus affecting the reaction rate. A rise in temperature initially increases reaction rate; then the influence of the media vapor pressure dominates and suppresses reaction rate. A mathematical model is proposed for the case of a second order reaction occurring on the surface of a solid catalyst. The model is expanded in terms of height of a reactor unit, height of a transfer unit, and height of a chemical unit. The problems involved in obtaining an analytical solution to this model are discussed. (Author abstract modified)

7066 APTIC NUMBER 15956

Slobodyanik, I. P.
TESTING OF A RING JET PLATE. (Ispytaniye kol'tsevoy struynoy tarelki). Text in Russian. Khim. i Tekhnol. Topliv i Masel, vol 11:38-42, 1966. 11 refs.

The hydrodynamics and mass transfer of a 300 mm diameter ring jet plate were studied under test conditions using desorption of carbon dioxide from water with air. Gas flow rates varied from 0.6 to 3.5 m/sec. The plate was found to have a low interphase resistance at high gas rates. High efficiency values and mass transfer coefficients, which proved stable over a wide range of gas velocities at various liquid velocities, were obtained. No spray entrainment occurred with high gas velocities. Ring jet plates are recommended for testing in petroleum towers where high productivity

is required and where the hydraulic resistance of the plate is of no practical importance.

7067 APTIC NUMBER 15803

Smedslund, Tor Halfdan
METHOD TO PREPARE SOLUTIONS OF GASES. (Aktiebolaget Centrallaboratorium, Helsinki, Finland) U. S. Pat. 2,539,871. 1p., Jan. 30, 1951. 5 refs. (Appl. July 17, 1945, 2 claims).

Gas solutions, e.g., acetylene, can be prepared for storage and transport by dissolving a gas in dimethyl sulfoxide. Obtained from the oxidation of dimethyl sulfide, a sulfate cellulose industry by-product, the solvent has greater dissolving properties than acetone. Moreover, it evaporates less easily than acetone, reducing liquid losses and simplyfying handling. Dimethyl sulfoxide can be used alone or in mixtures with acetone or other solvents.

7068 APTIC NUMBER 15799

Smith, Ennis C., Addison Y. Gunter, and Sydney P. Victory, Jr.
FIN TUBE PERFORMANCE. Chem. Eng. Progr., 62(7):57-67, July 1966. 22 refs.

The performance of air-cooled heat exchangers depends on the effectiveness of the fin tube and the air moving equipment; consequently, the following parameters were determined for extruded and tension wound fin tubes: joint contact pressure and isothermal temperature at which the contact pressure is exhausted as manufactured by both mechanical strain gauge and heat transfer tests; fin column stability as determined by visual means, photographically, and by strain gauges; effects of variation in intensity of thermal shock and cycling. The results indicated that isothermal mechanical strain gauge tests are an accurate means of determining isothermal temperature and the average contact pressure. Fin column stability is one of the important limitations of the maximum values obtainable for manufactured contact pressure and isothermal temperature. The average contact pressure obtained directly from strain gauge data was 1100 lbs/sq in. for the extruded fin tubes and 250 lbs/sq in. for the footed tension wound fin tubes at 80 deg F manufactured temperature. Tube liner protection is an important factor. The results were compared with previous recommendations and findings.

7069 APTIC NUMBER 15070

Smith, M. L. and K. J. Hill
OPERATIONAL EXPERIENCE WITH HERMES: THE HARWELL ACTIVE ELECTROMAGNETIC SEPARATOR. In: Proc. Isotope Separation, Amsterdam, 1957, J. Kistemaker, J. Bigeleisen, and A. D. C. Nier (eds.). New York, Interscience, 1958, Chapt. 49, p. 581-596. 5 refs.

Details are given of the vacuum system, gas system, electrical supplies, and magnetic stabilization of the Nier type, 90-deg sector electromagnetic isotope separator at the Atomic Energy Research Establishment, Harwell. The machine is enclosed in a sealed room so that it can be used for handling alpha-active elements. The source and collector units are placed outside the main magnetic field. Experience with plutonium shows that the completely automatic vacuum system, consisting mainly of rotary and oil diffusion pumps, is perfectly adequate. The electron input source unit has its own magnetic field and arc conditions for obtaining good focus, high output and high efficiency are extremely critical. The source can be used up to 1000 C. Maximum retention of isotopes in the pockets of the collector unit has been achieved. Enhancements, outputs, and efficiencies achieved in the first few separations were better than design anticipations. Outputs with sharply focused beams ranged from 1200 micron A with uranium to almost 2 mA plutonium. Further improvements are expected. Overall machine efficiency, i.e., collector current relative to source usage, has exceeded 4% in some runs with plutonium and uranium. Although the separator was primarily designed for isotope separation of the alpha-emitting actinides, it can also be used for other toxic and active materials. Preliminary assessments suggest that, with slight modifications to the plant, amounts of beta-active and gamma-active materials up to one curie can be handled in the source unit.

7070 APTIC NUMBER 15017

Snider, R. F. and K. S. Lewchuk
IRREVERSIBLE THERMODYNAMICS OF A FLUID SYSTEM WITH SPIN. J. Chem. Phys., 46(8):3163-3172, April 15, 1967. 11 refs.

The linear irreversible processes occurring in a fluid system whose molecules possess internal angular momentum are completely classified by means of irreducible Cartesian tensors in terms of the symmetry properties of the local equilibrium state of the fluid. It is assumed that this local thermodynamic state is characterized by the specific internal angular momentum as well as by the mass density and the specific entropy. Even with the resulting tensorial phenomenological coefficient, it is found, that there can be no contribution to the heat flux from the velocity gradient. (Author abstract modified)

7071 APTIC NUMBER 15032

Sobolev, Igor, J. A. Meyer, Vivian Stannett, and Michael Szwarc
PERMEATION, DIFFUSION, AND SOLUBILITY OF METHYL BROMIDE AND ISOBUTENE IN POLYETHYLENE. Ind. Eng. Chem., 49(3):441-444, March 1957. 20 refs.

Permeability constants, diffusion constants, and solubility coefficients were obtained for methyl bromide and isobutane vapors in polyethylene. The results are presented in the form of permeability isobars and permeability and sorption isotherms. The temperature dependence of the permeability constants for methyl bromide is shown for three different pressures: 100 mm, 300 mm, and 640 mm of mercury. The isobars corresponding to higher pressures depart markedly from the normally observed linear relationship, the permeability constants first decreasing and then

increasing as the temperature is progressively lowered. A similar behavior is observed in the permeation of isobutane. The minima of these isobars are shifted toward lower temperatures as the pressure is decreased, and at sufficiently low pressure, e.g., 100 mm, normal linear plots are obtained across the whole temperature range covered. At lower temperature both diffusion constants and solubility coefficients depart from normal linear relations. The diffusion constants are concentration-dependent and the activation energy required for diffusion decreases with increasing constant relative vapor pressure. The solubilities of constant relative vapor pressure are independent of temperature, indicating that lowering the temperature at constant pressure leads to the same sequence of effects as increasing the pressure at constant temperatures, i.e., in a proper scale the isobar at variable temperature is identical with the isotherm at variable pressure. Hence, the rapid increase in the solubility coefficient at constant pressure and variable temperature reflects the steep slope of the sorption isotherm.

7072 APTIC NUMBER 15867

IMPROVEMENTS IN THE PRODUCTION OF SOLUTIONS OF SULPHUR DIOXIDE. (Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauney et Cirey, Paris, France) British Pat. 675,831. 2p., July 16, 1952. (Appl. Jan. 2, 1951, 4 claims).

The production of sulfur dioxide solutions from glycol sulfite solvents is described. Sulfur dioxide can be purified or concentrated by absorption of the sulfur dioxide in the glycol sulfite. The gas is dissolved in the glycol sulfite by bubbling it through the liquid, passing the gas and liquid through a column, atomizing the liquid into the gas, or by other suitable means. The sulfur dioxide is extracted by heating. The advantage of glycol sulfite is that it absorbs a much greater amount of sulfur dioxide than water, salt solution, or usual organic solvents. It does not undergo chemical decomposition, does not require pressure to dissolve substantial amounts of the gas, and is less volatile than most organic solvents.

7073 APTIC NUMBER 16394

Society for Analytical Chemistry, London, Analytical Methods Committee
THE DETERMINATION OF PARTICLE SIZE. I. A CRITICAL REVIEW OF SEDIMENTATION METHODS. Cambridge, W. Heffer & Sons Ltd., 1968, 42p. 157 refs.

Sedimentation processes were reviewed and various methods of sedimentation analysis were evaluated according to their reproducibility, repeatability, and suitability for routine laboratory work. Distinctions were made between sampling errors caused by conditions departing from Stokes' law of particle diameter and those introduced by experimental techniques. Gravitational methods of sedimentation analysis were considered under two headings: two-layer methods and homogeneous sedimentation methods. Homogeneous methods were further subdivided into incremental, cumulative, and decantation methods. In all these methods, the rate of sedimentation of particles was measured indirectly in bulk suspension. Centrifugal methods of size analysis, which permit analysis of much smaller particle sizes than gravitational analysis, were also subdivided into two-layer and homogeneous techniques. A number of practical difficulties were associated with these centrifugal methods. The homogeneous method is plagued by an inexact solution of the differential equations involved in the determination. The theory is simplified for two-layer techniques, but experimental difficulties arise, particularly streaming. Development of the hindering process for settling particles in solutions may provide information on the behavior of slurries and a method of determining a mean particle size with respect to slurries formed in wet grinding and other ways. All methods referred to, and the size ranges they are capable of handling, were listed in an appendix.

7074 APTIC NUMBER 16509

Sosnovsky, H. M. C.
THE CATALYTIC ACTIVITY OF SILVER CRYSTALS OF VARIOUS ORIENTATIONS AFTER BOMBARDMENT WITH POSITIVE IONS. Phys. Chem. Solids, vol. 10:304-310, 1959. 15 refs.

Single crystals of silver with surfaces oriented parallel to (111), (110), and (100) were bombarded with positive argon ions at voltages between 14 and 4000 V. The catalytic decomposition of formic acid was used as a test reaction in the temperature range 150-250 C. For each of the crystals, the catalytic activity was measured as a function of the energy of the bombarding ions. The parameters, log A (frequency factor) and E (experimental activation energy) found from Arrhenius plots, change considerably with bombarding ion energy and are different for each ion energy for the three orientations. It was concluded that the reaction occurs at sites where dislocation lines intersect the surface and that a compensating effect occurs which is associated with interaction between dislocations when their density is high. (Author abstract modified)

7075 APTIC NUMBER 13417

Spealman, M. L. and W. H. Rodebush
THE REACTION OF SOME OXIDES OF NITROGEN WITH ATOMIC OXYGEN AND NITROGEN. J. Am. Chem. Soc., 57(8):1474-1476, Aug. 1935. 6 refs.

Laboratory observations of the reaction NO2 plus O equals NO plus O2, indicated a reaction probability of .00001 per collision at 40 deg. The reactions N plus NO2 equals 2NO, and N plus NO equals N2 plus O are shown to be fairly rapid. It is further reported that the reaction NO plus O equals No2 probably takes place by triple collision, and is accompanied by an oxygen afterglow.

7076 APTIC NUMBER 15409

Spiegler, K. S.
DIFFUSION OF GASES ACROSS POROUS MEDIA. Ind. Eng. Chem., 5(4): 529-532, Nov. 1966. 19 refs.

Basic laws of gaseous diffusion in porous media are derived directly from an extension of the friction model without recourse to detailed kinetic theory. The driving force of the friction model is counterbalanced by a friction force which consists of a term due to momentum exchange in collisions between gas molecules diffusing in opposite directions and another term due to collisions with the wall. The friction model, which is compatible with Newton's third law, does not violate the reciprocity relation of nonequilibrium thermodynamics. In self-diffusion, the transient pressure differences are very small, both the concentration gradients and the fluxes of the two gases are numerically equal and of opposite sign throughout experimentation, and the interdiffusion process follows a logarithmic decay law, characterized by a single interdiffusion coefficient. In another situation where both the concentration gradients and the diffusion fluxes between the closed vessels are numerically equal and opposed, the friction coefficient of the gases is negligible. This means that the number of gas-wall collisions is negligible compared to the number of gas-gas collisions. This phenomenon is called normal diffusion or normal interdiffusion. For a given gas pair, interdiffusion through a specific porous barrier plug is characterized by a set of three parameters; experimental parameters, friction parameters, and phenomenological coefficients. The description in terms of friction coefficients is useful because it leads to a number of important observed facts with a minimum of assumptions and does not contradict any observed findings. For ideal gases, it also permits the calculation of interdiffusion at any desired pressure from data obtained at other pressures.

7077 APTIC NUMBER 15791

Srinivasan, P. R., P. Gururaja, and A. Ramachandran
ISOTHERMAL PRESSURE DROP ALONG TRANSVERSE, TRANSVERSE HELICAL AND INCLINED FINS IN CIRCULAR ANNULI. Indian J. Technol. (India), 3(4):103-110, April 1965. 9 refs.

An experimental investigation was carried out on isothermal pressure drop characteristics for flow in modified circular annuli containing transverse, transverse helical, and a new type of inclined fin tubes. Experimental data were obtained for various values of fin spacing to fin height (s/e) ratio (0.75-2.1); the none-dimensional parameter, (D2-Df/D2-Dr), (0.3-0.75); inclination of the fin (30-60 deg); fin thickness (one-sixteenth and one-thirty-second in); and Reynolds number (50,000-85,000). For the same s/e ratio, the value of (D2-Df)/D2-Dr) was varied by varying the diameter of the outer pipe (D2) instead of (Df), as was done by previous workers. For a given s/e ratio, the pumping power decreased with an increase in the values of the non-dimensional parameter; for a given value of the non-dimensional papameter, the pumping power decreased with a decrease in the values of s/e. The inclination of the fins in the upstream direction brought about an appreciable increase in pressure drop. A comparison of the pressure drop characteristics of inclined fin tubes with those of transverse and transverse helical fin tubes of identical dimensions showed that inclining the fins beyond 30 deg in the upstream direction gave rise to a very large pressure drop. Eccentric mounting of the fin in the annulus brought about a reduction in pressure drop, the reduction depending upon the value of the non-dimensional parameter. The thickness and shape of the fin tip also influenced the pressure drop. A sharp fin edge and a thinner fin gave rise to a larger pressure drop, the effect again depending on the value of the non-dimensional parameter. In view of the large number of parameters involved, it was concluded that no general correlation is possible. Convective heat transfer from a surface to a fluid can be increased by the use of fins, as demonstrated. Extended surfaces of the finned type are used in compact heat exchangers and in the core of gas-cooled nuclear reactors in order to obtain high heat fluxes. (Author abstract modified)

7078 APTIC NUMBER 14571

Stadnik, P. M. and K. G. Stetsovich
DIVERSITY IN THE PROCESSES OF OXIDATION OF SULFUR DIOXIDE AND HYDROGEN ON PLATINUM CATALYST UNDER TEMPERING CONDITIONS AND IN AN ELECTRIC FIELD. (O razlichii kharaktera protsessov okisleniya sernistogo gaza i vodoroda na platinovom katalizatore v usloviyakh zakalki i elektricheskogo polya). Text in Russian. Katal. Katal. Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb., 1965:94-101. 9 refs.

Oxidation of sulfur dioxide on a flat platinum catalyst under conditions typical of tempering (300-600 C, starting SO2 concentration 9.5%), and with an electric charge applied to the catalyst (2693 V/cm, starting SO2 concentration 6.5%, catalyst temperature 500 C) was studied. Similar experiments were made with hydrogen at 150-300 C with a hydrogen/oxygen ratio of 6.5 in the first case, and with an applied voltage of 2500 V/cm, catalyst temperature of 100-500 C, and hydrogen/oxygen ratio ranging from 8 to 1/8 in the second case. Oxidation of sulfur dioxide was accelerated when a positive charge was applied to the catalyst and was retarded when a negative charge was applied. Hydrogen reaction was not affected by the applied field but was retarded by tempering conditions. It is concluded from these results that SO2 oxidation on platinum catalyst is heterogeneous, while reaction of hydrogen follows a heterogeneous-homogeneous path.

7079 APTIC NUMBER 14581

Stamm, Alfred J. and H. T. Sanders
SPECIFIC GRAVITY OF THE WOOD SUBSTANCE OF LOBLOLLY PINE AS AFFECTED BY CHEMICAL COMPOSITION. TAPPI, 49(9):397-400, Sept. 1966. 13 refs.

A method was developed for determining the relative holocellulose-lignin content of small mechanically isolated parts of a wood specimen. Measurements of the specific gravity of the substance of a single particle of the wood by the suspension method were used together with measurements of the specific gravity of the chemically isolated holocellulose and lignin substances from the same specimen. The method was used to determine the change in composition of loblolly pine in increments of 0.025 in. from the pith, which is high in lignin, through the heartwood and sapwood. The substance specific gravity and

the relative holocellulose content of the latewood were significantly greater than those of the earlywood only in the first few annual rings. The thicker and higher cellulose content of the S2 layer of the latewood compared to that of the earlywood accounts for the greater holocellulose content of the latewood in the first few annual rings. The practically negligible difference in the holocellulose content of the latewood and earlywood thereafter is microscopically demonstrated to be due to a compensating thicker middle lamella in the latewood, which is chiefly lignin. If the compound middle lamella is 70-80% lignin, the cell walls are estimated to be 18-25% lignin. (Author abstract modified)

7080 APTIC NUMBER 13544

Starkman, E. S. and H. K. Newhall
THERMODYNAMIC PROPERTIES OF METHANE AND AIR, AND PROPANE AND AIR FOR ENGINE PERFORMANCE CALCULATIONS. Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1967. 16 refs.

A chart-form review of the thermodynamic properties of selected fuel-air mixtures suitable for utilization in engine performance calculations was presented. Methane and propane, representative of natural gas, and LPG were the fuels considered. Comparisons were made between the performance to be expected with these gaseous fuels compared to octane as representative of gasoline. Cycle analysis showed loss in power could be anticipated when converting from gasoline fuel to LPG with further loss between LPG and natural gas.

7081 APTIC NUMBER 14961

Steinnes, E.
INSTRUMENTAL ACTIVATION ANALYSIS OF VEGETABLE TISSUE. Talanta, 14(7):753-758, 1967. 3 refs.

The presence of bromine, manganese, phosphorus, potassium, sodium, and zinc in plant tissue was analyzed by neutron activation and gamma-ray spectrometry. The experimental material, irradiated for 2 days, was leaves of Norway Spruce (Picea abies), an important raw material in paper manufacturing, although it is believed that the method can be applied to a great variety of plant material samples. Phosphorus and potassium were determined also by beta-counting. Experimental data are given; results indicate that the method described provides a rapid, non-destructive technique to supplement conventional methods of trace analysis of vegetable tissue, especially if computerization is applied to the resolution and evaluation of gamma spectra. The method seems especially valuable for the analysis of manganese and zinc, with an expected accuracy of determination of manganese of about plus or minus 3%. The expected accuracy for zinc is about plus or minus 10% or even 5% if the activation period is increased to 4-5 days. The probable accuracy of determination of potassium is plus or minus 5% for both beta- and gamma-measurements.

7082 APTIC NUMBER 14541

Stephens, E. J. and G. A. Morris
DETERMINATION OF LIQUID-FILM ABSORPTION COEFFICIENTS. Chem. Eng. Progr., 47(5):232-242, May 1951. 14 refs.

A new type of laboratory absorption column is described which is suitable for the determination of liquid-film transfer coefficients when reliable data on rates of diffusion are not available. This gives results for physical solution similar to those obtained in packed towers. If the relative performance of the laboratory column and various packings is established first for a known system (such as carbon dioxide-water) it is possible to predict the liquid-film coefficient for other systems with these packings by means of laboratory experiments. This procedure has the advantage of avoiding use of large quantities of gas and liquid necessary for experiments on a semitechnical scale. It is particularly convenient when it is required to determine absorption coefficients for systems which involve chemical reaction in the liquid. An account is given of experiments on the absorption of chlorine from mixtures with air into an aqueous liquor containing ferrous and ferric chlorides (initial composition 23.5 lbs FeCl2/cu ft; final composition 28.7 lbs FeCl3/cu ft) using this type of column. A correlation is presented covering the effects of liquid rate, concentration of unconverted ferrous chloride, and partial pressure of chlorine in the gas. It is shown that the results are consistent with the assumptions that a rapid reaction takes place in a narrow zone within the liquid film, and the rate of absorption is controlled by the rates of diffusion of the reactants. The correlation should not, however, be applied to weaker liquors of substantially lower viscosity. (Author abstract modified)

7083 APTIC NUMBER 16044

Stephens, G. K., R. J. Sinclair, and O. E. Potter
GAS EXCHANGE BETWEEN BUBBLES AND DENSE PHASE IN A FLUIDISED BED. Powder Technol. (Amsterdam), 1(3):157-166, Oct. 1967. 31 refs.

The rate of gas exchange between gas in bubbles and gas in the dense phase is important in designing a fluid-bed reactor. A gas containing mercury vapor in air was injected continuously at a point near the distributor into two fluidized beds with diameters of 2 and 6 in., maintained by tracer-free air-flow at or slightly above the incipient fluidization rate. A stream of bubbles containing mercury vapor tracer gas was produced. In the 2 in. diameter bed, the dense phase gas composition was radially uniform, but the concentration increased with height. This was presumably due to gas exchange with tracer-rich bubbles. In the 6 in. diameter bed, radial variations in composition of the dense phase were apparent. However, the average concentration over a cross-section also increased with height. The dense phase concentration reached the equilibrium concentration more rapidly as the bubble flow and particle size increased. Exchange coefficients were approximately determined and fair agreement was obtained with the values suggested by Davidson and Zenz. The solids employed were glass spheres, 50-380 micron in diameter. It was concluded that the injection of tracer bubbles is not desirable as a technique, but the almost total absence of

information on gas exchange rates warrants its use until a better one can be demonstrated.

7084 APTIC NUMBER 13748

Stevenson, F. J. and R. J. Swaby
NITROSATION OF SOIL ORGANIC MATTER: I. NATURE OF GASES EVOLVED DURING NITROUS ACID TREATMENT OF LIGNINS AND HUMIC SUBSTANCES. Soil Sci. Soc. Am. Proc., p. 773-778, 1964. 15 refs.

Manometric and infrared studies of the gaseous products formed by reacting HNO2 with humic and fulvic acids, lignins, lignin-building units, and polyphenols showed the presence of N2, N2O, and CO2. In addition, methyl nitrite (CH3ONO) occurred in the gases, obtained from lignins and certain phenolic derivatives. The CH3ONO originated through disputation of phenolic ethers, the CO2 from decarboxylation of aromatic acids and cleavage of ring structures. Aromatic-like substances interfere with the determination of free amino groups in soil organic matter by the Van Slyke nitrous acid method. (Author abstract)

7085 APTIC NUMBER 14385

Stezhenskiy, A. I., V. S. Luk'yanchikov, and V. P. Protsenko
OXIDATION OF NITROGEN DURING COMBUSTION OF METHANE-NITROGEN-OXYGEN MIXTURES. (Okisleniye azota pri gorenii metano-azoto-kislorodnykh smesey). Text in Russian. Khim. Prom. Ukr. (Ukr. Ed.), no. 1:7-9, 1967. 2 refs.

A methane-nitrogen-oxygen mixture was burned at a rate of 50 cu m/hr. Enriched air with an oxygen content of 40 to 73% was provided in an excess of 1.3 to 2.6. Inlet temperature ranged from 300 to 600 C and maximum NO yield (1.82%) was obtained with an oxygen content of 70% and an air excess of 1.7 (equivalent to equimolar nitrogen-oxygen ratio in combustion products). It is concluded that such a continuously operating arrangement for fixing atmospheric nitrogen has a number of advantages: constant NO concentration, ease of process control and possibility of automatic control, low thermal cycling assures prolonged and reliable operation of refractory materials made of MgO or ZrO2. The combustion chamber used was described in an earlier article.

7086 APTIC NUMBER 13546

Stoddart, E. M.
THE REACTION OF PHOSPHORIC ANHYDRIDE WITH NITROGEN DIOXIDE AND WITH NITRIC OXIDE. J. Chem. Soc., p. 1459-1461, 1938.

It was shown that nitrogen dioxide and phosphoric anhydride react at 250 deg to form a glassy compound, P2O5.2NO, with the liberation of oxygen. The compound P2O5.xNO2, previously identified by Smith (J. Chem. Soc., 1928:1886), does not appear to exist. It is clear that when Smith treated his material with water, nitric oxide was evolved but not noticed, in the reaction P2O5.2NO plus H2O yields 2HPO3 plus 2NO, and this gas reacted with the oxygen present to give the brown nitrogen dioxide. The compound P2O5.2NO is also formed by direct union of nitric oxide and phosphoric anhydride. The observations are important in considering the influence of intensive drying on the reaction between nitric oxide and oxygen.

7087 APTIC NUMBER 15283

Stowe, Harold W.
SIMULTANEOUS AUTOMATED BLOOD ALCOHOL AND CARBON MONOXIDE ANALYSIS. Preprint, Vermont State Dept. of Health, Burlington, 14p., 1969. 3 refs. (Presented at the Technicon Intern. Cong., Chicago, 1969.)

A simultaneous autoanalyzer was developed for low level carbon monoxide and alcohol determinations. An enzyme procedure was incorporated into the carbon monoxide manifold. Samples containing blood clots were aspirated, diluted with water and split into three aliquots for analysis of alcohol, carbon monoxide, and hemoglobin content. The fourth portion was discarded, thus disposing of most of the clots by gravity. The alcohol sample was segmented with air and further diluted with water. It was then dialyzed into a buffer. A buffered mixture of alcohol dehydrogenase and beta diphosphopyridine nucleotide was added and incubated at 37 C. The reduced diphosphopyridine nucleotide was read in a phototube colorimeter at 340 millimicrons; analysis time is 14 min. Sulfuric acid is added to the CO aliquot to release the gas. Caprylic alcohol is added as an anti-foam agent. The gas is reacted with an alkaline solution of silver p-sulfamoylbenzoate, which is reduced by CO to colloidal silver and measured at 420 millimicrons. To serve as a control, a simultaneous hemoglobin determination is made on a third portion of diluted sample. The reagent is modified to accelerate the conversion of carboxyhemoglobin to cyanmethemoglobin. An optical density chart paper simplifies calculations. A micro finger tip method was developed for use in a highway accident research project. The method was designed for quick, easy collection of finger tip blood in the field using the standard glucose Unopette, which consists of a 20 microliter disposable pipette and a diluent reservoir, factory loaded with 1.3 ml of 1% sodium fluoride. In the micro manifold, the undiluted sample is dialyzed into the buffer, after which it is diluted and split for carbon monoxide and hemoglobin analysis. There is no clot disposal system because there is no problem with clots when using Unopettes.

7088 APTIC NUMBER 16569

Streetman, J. B. and F. A. Matsen
A FLOW REACTOR FOR KINETIC STUDIES. Texas Univ., Austin, Dept. of Chemistry, Contract AF 18(600)-430, TN-18, OSR-TN-55-125, 15p., May 1955.
DDC AD 63363

A new flow reactor was constructed for the study of the kinetics of thermal reactions in acetylene and oxy-acetylene, particularly those with low oxygen concentrations. The purpose of the reactor was to obtain kinetic data such as specific reaction rate

constants, reaction orders, and apparent activation energies from a flow system. The reactor consists of a Vycor tube 214 cm long and having a bore of 1.3 cm. This choice was made so that essentially one-dimensional kinetics will prevail and the relatively simple one-dimensional equations will apply. The tube is electrically heated and the temperature automatically controlled and recorded. The flow of gases is measured by rotameters used individually and in combination. Continuous analysis is carried out on the product gases by an infrared spectrometer. Facilities were provided to permit dilution by helium, inhibition by nitric oxide, and activation by oxygen or ethylene oxide. A detailed description of the apparatus is given.

7089 APTIC NUMBER 16574

Strohmeier, Walter and Johann Friedrich Guttenberger
SULFUR-CONTAINING COMPOUNDS AS LIGANDS IN PHOTOCHEMICALLY PRODUCED DERIVATIVES OF THE CYCLOPENTADIENYL MANGANESE TRICARBONYL. (S-Haltige Verbindungen als Liganden in photochemisch hergestellten Derivaten des Cyclopentadienylmangantricarbonyls). Text in German. Chem. Ber., 97(7):1871-1876, 1964. 16 refs.

Cyclopentadienyl manganese tricarbonyl reacts photochemically with the donators D (D equals alkylsulfide, sulfoxide, sulfite, and sulfur dioxide) where CO is split off and the monosubstitutes C5H5Mn(CO)2D are formed. The manganese and donator D are bound by the sulfur. The possibility that they are bound by the oxygen has been ruled out for the following reasons: it has not yet been possible to isolate derivatives of C5H5Mn(CO)3 with O-bases; the frequency of the CO spectra of the studied sulfur complexes is in the range of those donators which are capable of forming electron acceptors; binding by the O-atom would shift the double bond SO frequency toward smaller wave numbers; and sulfones which have no free electron pair form no derivatives with C5H5Mn(CO)3. The tendency of the sulfur to form electron acceptors increases in the order R2S, (CH3)2SO, (CH2)4SO, (C6H5)2SO, (CH2CO)2SO, and SO2.

7090 APTIC NUMBER 15775

Stuart, W. I. and T. L. Whateley
ADSORPTION OF WATER AND CARBON DIOXIDE ON BERYLLIUM OXIDE. Trans. Faraday Soc., vol. 61:2763-2771, 1965. 28 refs.

Infrared spectrophotometry was used to investigate adsorption of water and carbon dioxide on beryllium oxide. The spectra of adsorbed carbon dioxide were related to kinetic and isothermal data. At 25 C, water is physically adsorbed, and also chemisorbed, to form surface hydroxyl groups. Physically adsorbed molecules are desorbed by vacuum pumping at 25 C, but hydroxyl groups are completely removed only after heating at 550 C. Between 25 and 200 C, carbon dioxide is chemisorbed to form a simple surface carbonate ion, CO3(2-), and a bidentate carbonate species. Above 300 C, only the carbonate ion is formed. Kinetics of chemisorption are exactly described by the Elovich equation. The intensity of an infrared absorption band at 1580 reciprocal cm increases markedly when water, deuterium oxide, or carbon dioxide is chemisorbed. These increases are thought to be related to formation of defects near the surface. A shift in the frequency to 1550 reciprocal cm when water or methanol molecules are physically adsorbed is due to hydrogen bonding between these molecules and the surface hydroxyl groups. (Author abstract modified)

7091 APTIC NUMBER 16572

Sugiyama, Kozo and Takehito Takahashi
PRODUCTION OF CHLORIDE GAS BY OXIDIZING POTASSIUM CHLORIDE AND SULFUR WITH PYRITE. (Enka-kariumu, pairaito oyobi yuo no sanka ni yoru enso seisei hanno). Text in Japanese. Kogyo Kagaku Zasshi (J. Chem. Soc. Japan), 68(3):433-437, 1965. 9 refs.

In the production of chloride (Cl2) by oxidizing KCl and S, the addition of pyrite (FeS2) increased the reaction velocity by maintaining a high temperature; it also increased the sulfur source as FeS2 and produced Fe3(SO4)3 as a catalyzer to oxidize SO2. The pyrite included 42.4% Fe and 42.9% S. The KCL and S were placed in a quartz cylinder, the internal volume of which was 212 cu cm, and oxygen gas was sent into this cylinder to oxidize materials, after which the materials were heated by an electric hearth at 500 to 800 C. The higher temperature showed larger reaction velocity (the reaction velocity at 700 C was twice as much as that at 500 C). There was little influence of the particle sizes of KCl and FeS2 on the production of Cl2. The reaction increased rapidly between 70 to 100 minutes after it began. The amount of sulfur to produce Cl2 was maximum when the weight ratio between pyrite and S was one to one, and it increased with the small amount of material compound when the compound had a definite weight ratio of KCl, S, and pyrite. Eventually the production ratio of Cl2 from KCl was 55 to 80% when the weight ratio of pyrite to KCl was 10 to 30%, the reaction temperature was 600 to 700 C, and the reaction time was 2 to 3 hours. This process produced Fe(SO4)3 and a mixture of K3Fe(SO4)3 and KCl, as determined by roentgenological analysis of rapidly frozen intermediate products.

7092 APTIC NUMBER 16082

Suter, C. M., P. B. Evans, and James M. Kiefer
DIOXANE SULFOTRIOXIDE, A NEW SULFATING AND SULFONATING AGENT. J. Am. Chem. Soc., vol. 60:538-540, March 1938. 12 refs.

The behavior of dioxane toward the additon of sulfur trioxide to form dioxane sulfotrioxide and disulfotrioxide was examined. Under anhydrous conditions both compounds are stable at room temperature, but on heating to 75 deg in carbon tetrachloride, decomposition ensues with formation of water soluble products. Both compounds react with water instantly to give sulfuric acid and regenerate dioxane. Either of the addition compounds serves as a reagent for sulfonation of benzene, m-xylene, anisole, naphthalene, phenol, and aniline. In the case of aniline, phenol and benzoic acid, the reaction occurs with the substituents rather than the benzene nucleus. Primary alcohols are converted into alkyl hydrogen sulfates. Since the higher members of this series are valuable detergents, this reaction has practical significance. Olefins are converted into compounds of the carbyl sulfate type

without undesirable side reactions. A study of the structure of the addition product indicates that the carbon-sulfur bond is formed at the end carbon. Hydrolysis of the primary addition product yields hydroxysulfonates. The alkali hydroxysulfonates obtained from olefins containing ten or more carbon atoms have marked detergent properties. Further investigation of these compounds is in progress.

7093

APTIC NUMBER 16490

Suzuki, H.
STUDIES ON THE DESULFURIZATION OF IRON SULFIDES (FES) BY SO2. (CHEMICAL REACTION OF IRON SULFIDES). (Aryusan gasu niyoru jiryutekko no datsuryu-hanno ni tsuite. (Hyukako no kagaku-hanno I)). Text in Japanese. Rikagaku Kenkyusho Iho (Bull. Inst. Phys. Chem. Res., Tokyo), 22:293-297, 1943. 5 refs.

Purified sulfur dioxide (SO2) gas was utilized to desulfurize iron sulfide (FeS) into sulfur (S) and iron oxide (Fe3O4). The FeS used in this procedure was composed of 30.34% S, 52.84% Fe, and 16.82% of other components including water, silica, and calcium. The material (FeS) in a small vessel was placed in a quartz cylinder and heated to 600 to 1000 C by an electric hearth within the current of nitrogen gas. Then the nitrogen gas was replaced by SO2 gas to desulfurize FeS. The ratio of this chemical reaction was increased with the increase of temperature and velocity of SO2 current. An almost complete reaction was obtained within 90 to 120 minutes when the temperature of the quartz cylinder was higher than 900 C, and the velocity of SO2 current was about 60 cc per minute. There was a correlation shown with a formula of x equals k + n -log v between the reaction ratio (x) and the velocity of SO2 current (v), where k and n were constant values for this formula.

7094

APTIC NUMBER 16201

Taylor, R. F. and T. R. Jenkins
A REVIEW OF SOME ASPECTS OF CONTINUOUS SOLIDS-GAS FLOW BEHAVIOUR IN TUBULAR REACTORS. Inst. Chem. Eng. Symp. Ser. (London), no. 27:101-111, 1968. 38 refs.

Although the flow behavior of solids and gases in fluidized beds has been extensively examined in recent years, there is a lack of comparative information on flow behavior in other types of industrial gas-solids reactors, e.g., blast furnaces, cement and lime kilns, and solid-fuel furnaces. The present paper reviews certain aspects of the overall mechanical transport of solid beds and gases in several types of tubular reactors. Aspects considered are the extent of gas and solid hold-ups, the amounts of solid recycling, the distribution of solids and gas flows, and changes in bed structure occurring during processing. Experimental data are presented where available and used as a basis for comparing the reactors. The material reviewed ranges from experimental studies on small-scale models to observations on the operation of production plants.

7095

APTIC NUMBER 14349

Terres, Ernst, Kurt Schultze, and Hermann Fortkord
ON THE REDUCTION OF SULFUR DIOXIDE WITH HYDROGEN AND CARBON MONOXIDE IN THE TEMPERATURE RANGE FROM 380 TO 850 DEG. (Ueber die Reduktion von Schwefeldioxyd mit Wasserstoff und Kohlenoxyd im Temperaturegebiet von 380 bis 850). Text in German. Angew. Chem., 45(8):164-171, 1932. 10 refs.

The constants of the equilibrium reactions 2SO2 plus 4CO yields S2 plus 4CO2 and 2SO2 plus 4H2 yields S2 plus 4H2O were measured from 550 to 850 C and from 370 C and up, respectively. These are intermediate reactions in generator and desulfurization processes. The thermodynamic constant was computed and the isochoric reaction characteristic was determined. In both cases, the computed curve agreed well with the experimental curve. For each measurement, a stoichiometric gas mixture of hydrogen or carbon monoxide and sulfur dioxide was used. The reaction tube was made of quartz and was embedded in an electrically heated porcelain tube. Two different catalysts were used for the reactions, namely, iron-free clay pieces with finely distributed platinum in the first case and iron oxide with asbestos and clay pieces in the second case. Initially, the flow velocity was 2.5 cm/hr, which was increased to 16 cm/hr at 600 C. Generally, it can be said that the reaction rates were relatively small but such that technical utilization of the reactions is feasible beginning at 500 C for the reduction with carbon monoxide and at 350 C for the reduction with hydrogen. In both cases, reaction is at 800 C, it still amounts to 80%.

7096

APTIC NUMBER 13433

Thein, Myint, J. M. Beck, Horace Johnson, W. W. Cooper, H. A. Reynolds, R. S. Clark, J. O. Baugh, and P. K. Kuroda
FRACTIONATION OF BOMB-PRODUCED RARE-EARTH NUCLIDES IN THE ATMOSPHERE. Environ. Sci. Tech., 3(7):667-670, July 1969. 14 refs.

The phenomenon of atmospheric fractionation of fission products occurs on a world-wide scale when fresh debris from a nuclear explosion travels eastward and circles the earth. A number of rare-earth nuclides have been studied, as well as Sr, Ba, Te, and I isotopes collected in rain at Fayetteville, Ark. The individual rare-earth nuclides were separated by a cation-exchanger resin and a concentration gradient-elution technique. Among the rare-earth radionuclides, 91Y and 141Ce were often depleted relative to other rare-earths in fallout samples collected several days after the Chinese nuclear detonation of December 27, 1967. This is due to the existence of gaseous precursors in the mass 91 and 141 chains. Pronounced fractionation was also observed for fission products at mass numbers A equal 89 ($S_r$), A equal 131 (I), and A equal 140 (Ba). (Authors' abstract modified)

7097

APTIC NUMBER 15121

Thiele, Everett
QUANTUM THEORY FOR UNIMOLECULAR RATE CONSTANT. J. Chem. Phys., 45(2):491-495, July 15, 1966. 19 refs.

A general theory of unimolecular reactions in the gas phase, which treats the unimolecular breakdown quantum mechanically, is presented. This theory retains some classical features by assuming that both collisions and reactions are events which occur at precisely defined times. Because of the uncertainty relation both of these events have a time uncertainty. This limits the range of applicability of the theory to pressures which are sufficiently low so that the mean time between collisions is much greater than this time uncertainty. This range of applicability of the theory includes the range of thermal experiments in the gas phase. A simple model is used to show that one can carry out a well-defined quantum calculation and obtain normal behavior for the rate constant. The usefulness of the proposed theory should be tested by calculations in the nature of the classical computer studies using Slater's new approach. A model calculation in which tunneling is important might be of special interest as an application of the quantum theory. (Author summary modified)

7098 APTIC NUMBER 15975

Tibor, Blickle, Janos de Jonge, Ferenczy Zoltan, and Pal Kaldi
THE OXIDATION OF SULFUR DIOXIDE WITH FLUIDIZED IRON OXIDE CATALYZER. (Kendioxid oxidalasa fluidizalt vascxid-katalizatorral). Text in Hungarian. Veszpremi Vegyi. Egyet. Kozle., vol. 5:109-120, Feb. 1962. 3 refs.

Theoretical and experimental investigations were conducted on the decrease in the rate of sulfidation of iron oxide under fluidization conditions in excess of 500 C. It was found previously that the fluidized iron oxide is a better catalyzer than vanadium pentoxide because (1) higher rates of reaction can be achieved in the sulfur dioxide oxidation process, (2) the iron oxide is less susceptible to catalyst-poisoning, and (3) iron oxide is more resistant to mechanical wear. The main drawback of iron oxide is that at its temperature limit of 620 C, where only 67.9% sulfur dioxide conversion takes place, the sulfidation of the iron oxide itself is very strong. The investigations show that even a slight amount of fluidization will prevent the sulfidation of the iron oxide. In the tests, the catalyzer was kept to 0.45 mm size, the gas flow contained 7% sulfur dioxide, 18.6% oxygen and 74.4% nitrogen at 450, 500, 550 and 600 C. The experimental reactor was a 3.8-cm diameter, chamotte cylinder surrounded by an electrical resistance heated oven. The paper defines the amount of fluidization by stating that the 0.45 mm catalyst particles were 'strongly' 'slightly' or 'not at all' fluidized. Regeneration of the iron oxide catalyst was also investigated in the fluidized-bed reactor; equations are given for calculating the time needed for regeneration of the catalyst. A theoretical equation derived for the nonfluidized catalyzer was found to be valid for the fluidized bed as well. The maximum amount of conversion was 90%.

7099 APTIC NUMBER 15118

Tiffany, W. B., H. W. Moos, and A. L. Schawlow
SELECTIVE LASER PHOTOCATALYSIS OF BROMINE REACTIONS. Science, 157(3784):40-43, July 7, 1967. 20 refs.

The nature and dynamics of a gaseous chemical reaction were studied by monochromatic laser light-induced photocatalysis. This was the first reported photochemical reaction of bromine with light in the 14,400 reciprocal cm spectral region. High-resolution absorption spectra of samples of pure Br2(79) and pure Br2(81) and natural Br2 were taken with a scanning spectrometer. In spite of the extremely close spacing of the individual lines, the spectrum of natural Br2 and certain strong lines belonging to the pure isotopes were indicated. From the addition of fluorocarbons to the bromine, it was shown that the primary photochemical process was the formation of stable excited bromine molecules with energies 500-800 reciprocal cm below the dissociation level. Thus, the use of monochromatic tunable laser light provided the first evidence of a photochemical reaction of bromine in which excited molecules, not atoms, were formed in the primary process. The mechanism of the subsequent reaction consists of collisional dissociation of the excited molecules into atoms, which then initiated free-radical chains. A quantitative estimate of the collisional electronic relaxation rate for excited bromine molecules was obtained, and a new upper limit to the continuous absorption strength at 14,400 reciprocal cm was determined.

7100 APTIC NUMBER 14572

Tikhonov, A. I. and I. T. Sryvalin
THERMODYNAMICS OF THE BASIC REACTIONS OF CHLORINATION ROASTING. (Termodinamika osnovnykh reaktsiy khloriruyushchego obzhiga). Text in Russian. Tr. Ural'sk. Politekhn. Inst., no. 98:33-40, 1960. 11 refs.

Results from thermodynamic calculations of the most important reactions of chlorination roasting over the range 573-973 C are presented. These reactions may be represented for the metals Na, Fe, Co, Ni, and Cu by the generalized formulas: Me plus Cl2 yields MeCl2; 2MeS plus 2Cl2 yields 2MeCl2 plus S2; 2MeO plus 2Cl2 yields 2MeCl2 plus O2 and its reverse; MeO plus C plus Cl2 yields MeCl2 plus CO: MeO plus CO plus Cl2 yields MeCl2 plus CO2; MeS plus 2O2 yields MeSO4; and MeSO4 plus 2NaCl yields Na2SO4 plus MeCl2. The values for standard isobaric potential and equilibrium constants tabulated were derived from data taken from both U. S. and USSR sources and may be used to study the mechanism of the process and to select process conditions.

7101 APTIC NUMBER 16060

Timberlake, C. F. and P. Bridle
FLAVYLIUM SALTS, ANTHOCYANIDINS AND ANTHOCYANINS. II. REACTIONS WITH SULFUR DIOXIDE. J. Sci. Food. Agr., 18(10):479-485, Oct. 1967. 14 refs.

Reactions between sulfur dioxide and flavylium salts, anthocyanidins, and anthocyanins were quantitatively and qualitatively studied. The results were consistent with the formation of a complex between sulfur dioxide and the flavylium

cation of mole ratio 1:1 and were expressed in terms of apparent formation constants (Ks). Complex stability, measured at a pH of 1.05, was reduced by hydroxylation of the 7- and 5-positions of the flavylium structure; the effect was most marked at the 5-position. Complex stability was increased by hydroxylation at the 3-position. The anthocyanins formed the weakest complexes of the compounds studied. Although complexes of the anthocyanin 3-glycosides were significantly weaker than those of the 3,5-diglycosides at a pH of 1.05, there was little difference between them at a pH of 3.5. The variation in their Ks values with pH could not be explained on the assumption that the ligand was simply the bisulfite anion HSO3(-). The findings with anthocyanins have an effect on the determination of free sulfur dioxide in fruit products. If anthocyanins are present, the sulfur dioxide with which they are combined at the normal pH of the product is instantaneously and very nearly completely liberated on acidification, thus giving a value of free sulfur dioxide which is greater than that present at the actual pH of the fruit product. The magnitude of error can be appreciable if the fruit product has a high anthocyanin content. (Author abstract modified)

7102 APTIC NUMBER 15102

Tip, A. A. E. DeVries, and J. Los
THERMAL DIFFUSION AND THE SENFTLEBEN EFFECT. Physica, 32(8): 1429-1436, Aug. 1966. 16 refs.

Thermal diffusion separation of radioactive krypton-85 in oxygen was studied at 279.1 K and 564 K both in the absence of a magnetic field and in the presence of a magnetic field of about 3000 gauss. The separation factor obtained with the field appeared to be equal to that obtained without the effect within an experimental accuracy of 0.4%. Similar results were obtained when the experiment was repeated at about 90 K and 300.3 K. It is concluded that the magnetic field does not influence the thermal diffusion coefficient. Analysis of a theoretical computation of field influence on the thermal diffusion coefficient and the ordinary diffusion coefficient leads to an explanation of why Senftleben did not find an appreciable field influence on the diffusion coefficient in a mixture with a high oxygen concentration.

7103 APTIC NUMBER 14392

Togasawa, Yoshihisa, Teizo Katsumata, and Tatsuro Ota
BIOCHEMICAL STUDIES ON POLLEN. PART VI. INORGANIC COMPONENTS AND PHOSPHORUS COMPOUNDS OF POLLEN. (Kafun no seikagakuteki kenkyu (dai 6 ho) kafun no mukiseibun oyobi kakushu rin kagobutsu ni tsuite). Text in Japanese. Nippon Nogeikagaku Kaishi (J. Agr. Chem. Soc. Japan), 41(5):178-183, 1967. 35 refs.

The anemophilous pollen of Pinus Banksiana, P. Thunbergii, P. densiflora, and Zea Mays and the entomophilous pollen of Cucurbita maxima, Lilium lancifolium, L. cardifolium, Narcissus Pseudo-Narcissus, and Iris Pseudacorus were studied for inorganic components. The anemophilous pollen and the pollen of C. maxima, L. lancifolium, N. Pseudo-Narcissus, and Magnolia liliflora were also studied for phosphorus compounds. Spectrographic analyses revealed that Na, K, Mg, Ca, Sr, Zn, Mn, Fe, Al, Cu, B, Si, and P were present in all samples; Ni and Cr only in L. lancifolium, N. Pseudo-Narcissus, and I. Pseudacorus; Pb in P. Thunbergii, P. densiflora, and Zea Mays; Ti in all samples except C. Maxima, L. cardifolium, and I. Pseudacorus. A remarkable finding was the high content of K (approximately 902.7-1543.6 mg% on the dry basis). Approximate P content in the pollen of Pinus (344.3-452.4 mg%) was less than that of angiosperms (615.2-1102.8 mg%). Approximate contents of other inorganic components were as follows: Mg 96.7-170.3, Ca 36.2-99.4, and Si 25.4-171.1 mg%. The contents of Na, Fe, Al, Zn, Cu, and Mn were negligible. The approximate distribution of phosphorus was as follows: acid-soluble P, 141.5-632.1; phospholipid-P, 103.9-258.0; RNA-P, 38.2-133.6; DNA-P, 11.2-58.1; phosphoprotein-P, 17.3-61.9; and insoluble-P, 1.7-6.9 mg%. Acid-soluble P constituted approximately 40.6-57.3% of the total phosphorus for all samples. (Author abstract modified)

7104 APTIC NUMBER -----

Topol, L. E.
THERMODYNAMIC CONSIDERATIONS IN MOLTEN METAL-METAL SALT SOLUTIONS. J. Phys. Chem., 69(1):11-17, Jan. 1965. 17 refs.

The standard free energies of dissolution of isolated metal atoms with the molten chloride of that metal were calculated from vapor pressure and solubility data for 34 systems and these values were correlated. This correlation allows one to classify systems in terms of the magnitude of the energies and to estimate the solubilities in some systems where experimental data are not available. To calculate the solution energy of isolated metal atoms with a fused salt, the dissolution of a metal as the removal of metal atoms from the bulk metal to the gas phase followed by the interaction of the atoms with the solvent to yield a solution with a fixed concentration must be considered. On the basis of the magnitude of the standard free energies between individual atoms of metals and their molten chlorides, two chief classifications of metal-salt systems were made. In the first category are systems which exhibit relatively weak solution energies and consist primarily of mono- and divalent metals. The second category includes transition and trivalent metals which are characterized by relatively strong solution energies.

7105 APTIC NUMBER 16481

Trandafelov, D. and D. Mihailova
STUDIES OF THE TRIPLE SALT SYSTEM OF SODIUM, CADIUM AND AMMONIUM NITRATES. (Izledvane na troynata soleva sistema ot nitratite na natriya, kadmiya i amoniya). Text in Russian. Nauchni Tr. Visshiya Med. Inst. Sofiya (Sofia), 41(4):57-66, 1962. 6 refs.

The triple salt system of sodium, cadmium, and ammonium nitrates was investigated by the visual-polymetric method. An incongruous melting compound with the formula Cd(NO3)2-2NH4NO3 was found in

the double ammonium nitrate-cadium nitrate system. The surface of the liquid phase was investigated by polythermic sections. Two triple invariable points with melting points of 70 to 71 were found. The field of existence was determined for easily supercooled melts which form glass upon cooling. The surface of the equilibrated existence of the compound Cd(NO3)2-2NH4NO3 was also determined. It was very small which showed the instability of this compound. The investigation corroborated the similarity between ammonium and potassium ions, as well as the other ions of the alkaline metals which all form compounds of the same type with cadium nitrate.

7106 APTIC NUMBER 15454

Troetsch, E. and G. Dickel
CALCULATION OF SQUARED OFF CASCADES FOR ISOTOPE SEPARATION BY DIFFUSION. (Die Berechnung von gestaffelten Trennkaskaden bei Diffusionsverfahren). Text in German. Kerntechnik, 8(1):18-22, 1966. 4 refs.

The ideal continuous cascade for gaseous isotope separation was approximated by one optimum squared-off cascade. An optimum cascade has minimum energy consumption. The solution of the variational problem was found by solving the associated Euler's equations. The resulting transcendental expression is evaluated numerically and graphically. Normalized cascade parameters as functions of initial and final mole concentrations are presented in tabular form. Tables of efficiencies defined as the ratio of energy consumption over ideal energy consumption are given. The use of the tables is illustrated by means of a numerical example, in which an ideal cascade is replaced by one, two, and three squared-off cascades.

7107 APTIC NUMBER 16455

Turk, Amos
CONCENTRATIONS OF ODOROUS VAPORS IN TEST CHAMBERS. In: Basic Principles of Sensory Evaluation. American Society for Testing and Materials, Philadelphia, Pa., STP-433, p. 79-83, 1968. 2 refs.

Factors that determine the changing and equilibrium concentrations of odorous vapors in test chambers were mathematically considered. Processes that tend to increase the concentration of odorous vapors are the generation of vapor within the space, and the introduction of vapor by replacement of chamber air by ventilation or infiltration with outdoor air of higher vapor concentration. Processes that tend to decrease the concentration of odorous vapors are the treatment of the chamber air by a vapor-reducing device, and the removal of vapor by replacement of chamber air by ventilation or infiltration with outdoor air of lower vapor concentration. The equations for the concentration of vapors at any time and at equilibrium were given. The simplified equations which apply to only special cases were also given for the following: ventilation air is pure, when no vapor is generated or injected, when the vapor reducing device is 100% efficient, when the chamber is originally pure, and when the air is tight. Equations are given for combinations of the conditions. A mixing factor may be applied to account for the fact that dilution of air is not instantaneous, and that concentration fall-off rates are actually smaller than the ideal values given by the equations. An equation is also given to calculate the efficiency of a vapor reducing device in a chamber from odor dilution methods determined at different times, or to calculate the time interval between sensory tests that is needed to provide a specified diminution of vapor concentration.

7108 APTIC NUMBER 14564

Ukshe, Ye. A. and V. N. Devyatkin
DIFFUSION OF HYDROGEN CHLORIDE IN FUSED SALTS. (Rastvoreniye khloristogo vodoroda v rasplavlennykh solyakh). Text in Russian. Zh. Fiz. Khim., vol. 39:2288-2291, July-Sept. 1965. 10 refs.

The solubility of hydrogen chloride in fused chlorides of lithium, sodium, potassium, and rubidium was examined over a wide temperature range by displacement with argon. Solubility curves are satisfactorily described by an exponential equation. Solubilities in the temperature range 800-1000 C occur in the increasing order: LiCl, NaCl, KCl, RbCl. Heats of solution were found to be negative for LiCl, NaCl, and KCl, and positive for RbCl. The heat of solution was found to be in inverse relation to the total crystalline ionic radii of the salts. It is suggested that proton-chloride complexes with a binding energy of about 53.5 kcal/mole are formed in the fused salts.

7109 APTIC NUMBER 14979

Ukshe, Ye. A. and V. N. Devyatkin
DIFFUSION OF HYDROGEN CHLORIDE IN FUSED KCl-NaCl MIXTURES. (Rastvoreniye khloristogo vodoroda v rasplavlennykh smesyakh KCl-NaCl). Text in Russian. Zh. Fiz. Khim., vol. 39:3074-3076, Oct./Dec. 1965. 4 refs.

Experimental data on the solubility of HCl in molten mixtures of NaCl and KCl are presented, and the calculated heat of solution is plotted. Solubility was found to increase as the KCl content of the melt decreased. Solubility decreased with temperature when the NaCl-KCl mixture was equimolar but increased with temperature in all other cases (0, 25, 75, and 100% NaCl). The heat of solution of HCl depends upon salt composition and exhibited a minimum for an equimolar mixture. It is proposed that the heat of diffusion varies with mixture composition in connection with a disruption of symmetry in the chloride lattice. Measurement was based on the displacement of HCl by argon using a method described in an earlier article.

7110 APTIC NUMBER 16511

Urrutia, John
COMPUTER ORIENTED PROGRAMMING FOR ENVIRONMENTAL TEST CHAMBERS. Inst. Environ. Sciences, Inst. Environ. Sci. Ann. Tech. Meet., 14th, St. Louis Mo., 1968, p. 115-120. (April 29-May 1.)

Environmental parameters in the first generation of program-controlled test chambers were usually manually attended and changed

automatically as a function of time. This type of programming can still be used when transient rate control is not required or where step changes limited only by the capacities of the heating and cooling systems in the case of temperature control, or vacuum pumping in the case of an altitude simulator, can be tolerated. With the advent of more complex electronic packages, it became necessary to provide programmed test systems to test components in the ultimate system operation environment. This environment includes, for example, electrical input [illegible] noise current levels and fast rise time. Such testing requ[illegible] programmed inputs and data acquisition, sorting of devices, [illegible] of-reject decisions on quantities of circuits and devices [illegible] ast generation of environmental test facilities will in[illegible] computer-controlled systems to evaluate, act on, and recor[illegible] ured parameters. Advantages of the computer will be the automatic step control or profile control of chamber environmental parameters or chamber parameters. If the environmental program is integrated into the computer system, the computer can function as a completely closed looped system rather than simply a data logger and analyzer. Although direct control of test chamber parameters by a digital control system would eliminate all analog instrument subsystems, the supervisory mode control represents the most versatile approach for environmental test facilities. In this system, the computer output is converted to analog and used to provide the set point for analog controllers.

7111

APTIC NUMBER 14638

Ushakov, K. I., O. V. Nadinskaya, I. G. Dobrochiver, and S. P. Zharova
REDUCTION OF SULFUR DIOXIDE BY COKE UNDER CONDITIONS APPLICABLE TO COPPER-SULFUR SMELTING. (Vosstanovleniye sernistogo gaza koksom primentil'no k usloviyam medno-sernoy plavki). Text in Russian. Sb. Nauchn. Tr., Gos. Nauchn.-Issled. Inst. Tsvetn. Metal., no. 26:168-177, 1967. 16 refs.

A laboratory study of the reduction of sulfur dioxide by coke was carried out for the purpose of making separate determinations of SO2, H2S, CO, CO2, COS, and CS2 contents in the gas phase using gas-liquid chromatography. These studies were directed toward optimizing the production of elemental sulfur during copper-sulfur smelting. Experiments were made with a charge containing 10% coke and 90% quartz at 100-deg intervals from 700 to 1200 C. The coke contained 74% carbon and 11.5% ash; its porosity was 32.5%, and specific gravity was 1.67. The incoming gas mixture was 10% SO2 and 90% N2; contact time was 4 sec. Additional tests were made at 1200 C with a charge of 100% coke for various SO2 contents in the starting gas (4.4-11.9%) and with various contact times 4.4-5.0 sec). Reduction of SO2 began at 800 C and increased with temperature and the amount of coke present, reaching 83% at 1200 C with 10% coke, and 92.1% with 100% coke. Increasing contact time above 4 sec had practically no effect on the degree of reduction. It is recommended that the SO2 content of the furnace gas be 2.5-3.0% with an optimized coke content.

7112

APTIC NUMBER 15101

Valance, W. G. and E. W. Schlag
THEORETICAL RATE CONSTANT FOR THERMAL UNIMOLECULAR REACTIONS IN A MULTILEVEL SYSTEM. J. Chem. Phys., 45(1):216-223, July 1, 1966. 26 refs.

A macroscopic unimolecular rate constant is given in terms of the detailed microscopic rates of transport and relaxation in a many-quantum-level system. A rate equation for each quantum level represents all input and output processes. The resulting set of equations constitutes a master equation. The conventional unimolecular rate constant is then the lowest eigenvalue to the relaxation problem defined by the master equation. This is, therefore, a general prescription for the theoretical treatment of unimolecular behavior based only on the assumed mechanism and explicity including the multilevel behavior of real systems undergoing chemical reaction. General methods for solving this eigenvalue problem are discussed. These methods are illustrated with the master equation for a generalized Lindemann mechanism. The lowest eigenvalue for this mechanism is obtained by an iteration procedure. The zero-order result of the iteration is equivalent to the rate constant derived from a steady-state approximation. Both the zero-order and exact expression for the lowest eigenvalue are given in terms of a computationally useful many-shot expansion. The lowest eigenvalue result then constitutes an exact and computationally simple version of the unimolecular rate constant which is an unambiguous consequence of the microscopic parameters inserted into the chosen relaxation mechanism. Since the particular mechanism used here is also the point of departure in the derivation of the well-known Rice, Ramsperger, Kassel, and Marcus (RRKM) theory of unimolecular reactions, the lowest eigenvalue solution is directly compared with the RRKM rate constant. The additional restrictive conditions for agreement between the two rate constants are enumerated. Some generalized expressions for mean first passage times in unimolecular rate theory are also derived and expressed in terms of many-shot solutions. These latter expressions are computationally useful for extremely rapid reactions. (Author abstract modified)

7113

APTIC NUMBER 15035

Valance, W. G., E. W. Schlag, and J. P. Elwood
THEORY OF THE DISSOCIATION KINETICS OF DIATOMIC MOLECULES. J. Chem. Phys., 47(9):3284-3291, Nov. 1, 1967. 30 refs.

A general rate constant for the reaction of diatomic molecules is presented. The derivation directly includes nonequilibrium and non-steady-state effects, unless these are explicitly excluded, which can be done readily. Collisional transition probabilities of any general form can be employed in the evaluation of the final rate constant. The specific case of a nearest-neighbor model (one-quantum transitions) is also investigated, since this leads to some great simplifications in the final rate constant. An upper and a lower bound to this rate constant are derived, and are shown to be usually extemely close to one another. The exact solution for this case is given in

terms of an iteration of the lower-bound solution. A value can be computed for the upper-bound solution which lies above that computable from any specific transition probability model, and is independent of such models. In using this maximum value for a nearest-neighbor rate constant it is shown that this value usually lies below the experimental values, hence indicating an inherent inadequacy in the nearest-neighbor model for at least these reactions. These results are also compared with those from simple-collisional theory and a non-nearest-neighbor model. (Author abstract modified)

7114 APTIC NUMBER 14510

Van Artsdalen, Ervin R.
COMPLEX IONS IN MOLTEN SALTS. IONIC ASSOCIATION AND COMMON ION EFFECT. J. Phys. Chem., vol. 60:172-177, Feb. 1956. 12 refs.

The concepts of complex ion and ideality were considered in the case of molten salt solutions. Freezing point depression measurements in molten sodium nitrate as solvent were used to determine the nature and number of ions into which several solutes dissociate. It was demonstrated that a number of salts of relatively simple oxy-acids, as well as many other simple salts, are stable and remarkably ideal in solution in molten sodium nitrate. Partial dissociation and complex ion formation were shown to exist at high dilution in the case of lead(II) chloride, copper(II) chloride, cadmium chloride, zinc chloride, and cadmium bromide. The important species in the solutions appear to be those with zero, two, and four chlorines per (II) metal ion. The occurrence of the common ion effect is amply substantiated with these compounds and chloro anions containing the (II) metal exist even at low concentrations. Reactions were proposed which account for the results, and equilibrium constants were calculated for these reactions. (Author abstract modified)

7115 APTIC NUMBER 13462

Viola, G.
HOW RICE AND WHEAT STRAW ARE PULPED IN THE KOCANI MILL IN YUGOSLAVIA. Paper Trade J., 150(24):74-76, June 13, 1966.

The Kocani mill which utilizes local rice and wheat as raw material is described. The mill pulps rice and wheat straw by the soda-chlorine process in the same equipment without modification. The bleached pulp from both wheat and rice straw is of a quality useful in the manufacture of fine writing and printing paper. The efficiency of the straw pulping method depends on the quality of straw from the cutters. Therefore, dimensions and cleaning process are rigidly regulated. Rice straw has a high silica content which makes proper cooking conditions essential to reduce ash. These conditions are discussed in detail with respect to two stage digestion.

7116 APTIC NUMBER 16051

Vodar, Boris
ABSORPTION COEFFICIENTS OF GASES IN THE RANGE FROM 100 A TO 500 A. High Pressure Lab., Bellevue, France, Contract DAJA37-67-C-0388, Final Tech. Rept., Proj. 20014501B11B, 30p., March 31, 1968. 30 refs.

Absorption spectra between 100 and 500 A for NO, CO, CO2, H2O, NH3, CH4 a grazing incidence were obtained with grating spectrograph, a condensed spark as the continuum background, and very thin layers of appropriate materials for cell windows. This region is characterized by continuous absorption rapidly decreasing towards short wavelengths, commonly attributed to photoionization processes. Striking features in the spectra up to higher energy corresponding to ionization of an inner shell electron were not expected. Whenever possible, results near 500 A were compared to results of other authors, and agreement was generally satisfactory. Comparisons were made between absorption curves of similar molecules such as H2O, NH3, and CH4. Except for CH4, it was not possible to relate experimental results to theoretical calculations because no adequate theory of the photoionization of molecules exists. The high symmetry of CH4 permits a calculation on a quasi-atomic basis.

7117 APTIC NUMBER 14517

Voloshin, A. G.
ELECTROCHEMICAL BEHAVIOR OF SULFUR DIOXIDE STUDIED BY OSCILLOGRAPHIC POLAROGRAPHY. Soviet Electrochem. (English translation from Russian of: Elektrokhimiya), 3(7):719-724, 1967. 14 refs.

The reduction of SO2, or undissociated H2SO3, was investigated on the surface of a polarized electrode in solutions containing SO2, or H2SO3, HSO3(-), and SO3(2-). Waves obtained by oscillographic polarographic measurements had kinetic and diffusion components, whose ratio depended on the solution pH. A diffusion current was present at all pH values, while a kinetic current was present at the highest pH. At any pH, the anodic current was due to the two-electron oxidation of H2SO2, or HSO2(-). With increasing pH, the direction of the cathodic process changed. As it oxidized, the product of the two-stage reduction, HSO2(-), gave the kinetic anodic wave. It is inferred that chemical reactions take place between SO2, or HSO3(-), in the vicinity of the electrode and preceding discharge, leading to the formation of two types of electrochemically active elements. One is reduced with participation of two electrons, the other with participation of one electron. In strongly acidic solutions (0.05 N HCl) the two electron process proceeds according to the reaction SO2 plus 2H(I) plus 2e yields H2SO2; in neutral or weakly acid solutions, it proceeds according to the reaction HSO3(-) plus 2H(I) plus 2e yields HSO2(-) plus H2O.

7118 APTIC NUMBER 15328

Wagenmann, Rolf, Eva Scherz, and Beate Puchta
METHOD FOR REFINING OF SELENIUM. (Verfahren zur Raffination

von Selen). Text in German. (Assignee not given.) E. German Pat. 27,336. 2p., Jan. 28, 1964. (Appl. Aug. 17, 1963, 1 claim).

A method for refining selenium was devised and is characterized by addition of strong oxidants to impure selenium in the molten state. As oxidants, KNO3 or NaNO3 alone or mixed with KOH or NaOH can be used. The reaction follows the equation KNO3 + Se yields KNO2 + SeO. An example of the process is the following: 100 kg Se with 0.1% As was melted and 8 kg NaNO3 was added. The refining process took place at 320 to 340 C with constant agitation and lasted 30 min. Good separation of the selenium from the salt melt was achieved. Spectrometric analysis of the selenium showed that all the As was removed.

7119 APTIC NUMBER 15780

Walters, C. L., R. L. Casselden, and A. McM. Taylor
NITRITE METABOLISM BY SKELETAL MUSCLE MITOCHONDRIA IN RELATION TO HAEM PIGMENTS. Biochim. Biophys. Acta (Amsterdam), 143(2):310-318, 1967. 15 refs.

An enzymic pathway was proposed for formation of NOMb (nitrosylmyoglobin), the end product of part of the nitrite metabolized anaerobically by skeletal muscle. Skeletal muscle mitochondria were prepared from the diaphragm of a pig. Mitochondria were spectrophotometrically analyzed for heme and NADH. Nitrite was reduced anaerobically by skeletal muscle mitochondria. A product of the reaction was nitrosylferricytochrome c. The anaerobic incubation of nitrite with skeletal muscle minced at pH 6 leads to the formation of nitric oxide, part of which ultimately combines with endogenous myoglobin. Pig oxymyoglobin was readily oxidized to the met- form by low concentrations of nitrite, but nitrosylmyoglobin was relatively stable. Under argon, metmyoglobin was insensitive to reduction by pig muscle mitochondrial enzyme systems and NADH, but nitrosylmetmyoglobin was readily reduced to nitrosylmyoglobin. The incubation of nitrosylferricytochrome c and metmyoglobin with muscle mitochondria and NADH under N2 resulted in the formation of ferrocytochrome c, which does not form a nitrosyl complex, and a stoichiometric equivalent of nitrosylmyoglobin, with nitrosylmetmyoglobin as an intermediate. Thus, nitrosylferricytochrome c, formed by anaerobic cytochrome oxidase action in the presence of nitrite is reduced by the reduced NAD dehydrogenase system of muscle. The nitrosyl group transferred to metmyoglobin which arises from the chemical oxidation of endogenous myoglobin by nitrite. Mitochondrial reduction of nitrosylmetmyoglobin to the stable nitrosylmyoglobin complex follows even in the presence of sufficient nitrite to oxidize oxymyoglobin. (Author summary modified)

7120 APTIC NUMBER 15015

Walton, Peter H. and Richard M. Noyes
REACTIONS OF DIATOMIC MOLECULES. III. KINETICS OF FORMATION OF IODINE BROMIDE. J. Am. Chem. Soc., 88(19):4324-4325. Oct. 5, 1966. 6 refs.

Stopped-flow measurements for iodine bromide in carbon tetrachloride are reported. Iodine bromine in carbon tetrachloride at 26.3 degrees react by a bimolecular mechanism with rate constant of 5101./mole sec. This is the first quantitative kinetic study of a halogen-halogen reaction, and the result is in good agreement with recent calculations indicating that such reactions should proceed by bimolecular mechanisms. (Author abstract modified)

7121 APTIC NUMBER 15811

Ward, J. W. and H. W. Habgood
THE INFRARED SPECTRA OF CARBON DIOXIDE ADSORBED ON ZEOLITE X. J. Phys. Chem., 70(4):1178-1182, April 1966. 9 refs.

Absorption bands of carbon dioxide on various cationic forms of zeolite X were obtained between 2200 and 2500 reciprocal cm and below 2000 reciprocal cm. Spectra of carbon dioxide adsorbed on the Ca, Sr, and Ba forms showed no evidence of bent or carbonate-like structures such as reported for carbon dioxide adsorbed on LiX, NaX, and KX. This difference is believed to be due to the absence, in zeolites containing divalent cations, of any cations in the highly exposed type-III sites. Carbon dioxide on MgX showed some carbonate-like bands in the 1300-1750 reciprocal cm region, but apparently only partial replacement of monovalent cations was achieved. The spectra of carbon dioxide on both group I-A and group II-A zolites showed a strong band between 2350 and 2375 reciprocal cm, the stronger the electrical field of the cation the higher the frequency. This band was accompanied (in most cases) by two pairs of weaker side bands symmetrically spaced about the central band. It is concluded that the band observed at high pressures at or slightly below 2350 reciprocal cm is due to the physical absorption of carbon dioxide; the bands in the 1300 to 1750 reciprocal cm region with LiX, NaX, and KX to chemisorption; and the band at low pressures between 2350 and 2375 reciprocal cm to adsorption by an ion-dipole interaction.

7122 APTIC NUMBER 15168

Watson, W. W.
THE PERFORMANCE OF THERMAL DIFFUSION COLUMNS. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. O. C. Nier (eds.), New York, Interscience, 1958, Chapt. 34, p. 446-461. 20 refs.

The suitability of large-scale thermal diffusion equipment for the production of sizeable amounts of well-separated isotopes of noble gases is discussed. Performances of multistage glass and multistage metal columns, both of the hot wire and concentric cylinder type, are contrasted, and comparison is made between experimentally observed separation factors and calculated theoretical values. The separation factor in concentric cylinder columns is disappointingly small because of parasitic remixing of gases resulting from azimuthal temperature differences. Hot-wire metal columns, on the other hand, give good agreement with theory. Cross-wire spacers do not improve

the separation factor of these columns, indicating that when construction of thermal diffusion equipment approaches the theoretical ideal, i.e., no irregularities in wire-to-wall spacing and absolutely straight columns, spacers are not needed. This ideal can seldom be realized with glass columns, and their performance is improved by attaching cross-wire spacers at regular intervals along the hot wire. The spacers are assumed to increase the average gas temperature and, consequently, the thermal diffusion factor. For all columns, the separation factor is larger when gas flow is turbulent than it would be if flow remained strictly laminar in the high pressure range. In multistage apparatus, capillary connection between columns requires less power and less inoperative volume than convection coupling. It is assumed that laboratory batch-wise recycling procedures can be extended to a large-scale plant with continuous feed and bleed in a multiple cascade.

7123 APTIC NUMBER 13773

Weeks, Edward J.
THE ACTION OF SULPHUR DIOXIDE ON SODIUM CHLORIDE. Chem. News, vol. 144:50-51, Jan. 22, 1932. 2 refs.

Some pure precipitated salt was weighed and pure dry SO2 was passed over it while it was heated. The excess SO2 was absorbed in caustic potash or in water. The salt was found to slowly increase in weight. Qualitative examination of the substance showed the presence of chloride, sulfur, and sulfate. It was therefore assumed that the action followed the equation 2SO2 plus 2NaCl yields Na2SO4 plus Cl2 plus S. To accelerate the reaction, dry oxygen was admitted with the SO2. Fumes of SO3 were immediately obtained and sulfur was deposited on the cooler parts of the tube. Qualitative tests showed the presence of sulfate and chloride in the solid, and hydrochloric and sulfuric acids in the water. The sodium chloride was found to fuse during the reaction, producing a hard glassy solid. After conducting analytical tests, the formula of this substance was assumed to be Na2SO4.3NaCl. This would give sulfate 30.2% and chloride 33.5%, which agrees well with the values found.

7124 APTIC NUMBER 14969

Weigman, Bernard J. and Albert Pfeiffer
MEASUREMENT OF THE RELATIVE DISPERSIBILITIES OF POWDERS IN TABLET FORM. Dept. of the Army, Edgewood Arsenal, Md., Chemical Res. Labs., Proj. 1C522301A060, Task 1C5223C1AC6006, EATR 4151, 40p., Dec. 1967. 10 refs.

To compare the relative dispersibilities of powdered agents, a grinder that can pulverize and disperse powdered materials in tablet form was developed and tested for its effectiveness and reproducibility. The grinder was tested in a fallout chamber. A known weight of a tableted powder, aspirin, saccharin, or Sucaryl, was placed in the device. A jet of compressed air pulverized the powder and at the same time dispersed it in the chamber. With 32 aluminum foils and eight wooden paddles placed on the floor of the chamber (sampling procedure), the weight of the powder deposited on the floor after 10 min and after 20 hr was measured. The percentage of material that was still airborne after 10 min for saccharin, aspirin, and Sucaryl approximately was 74.1%, 77.6%, and 63.1%, respectively. Thus, the percentage of material falling out in the first 10 min for saccharin, aspirin, and Sucaryl was approximately 22.4%, 25.9%, and 36.9%, respectively. It was concluded that the grinder is capable of disseminating a fine, reproducible aerosol in a volume of about 18 cu ft. This device, used in a fallout chamber, is able to distinguish between the dispersibilities of at least three different powders. In addition, based on Stokes' settling law, one may conclude that over 60% of the three powders dispersed has a particle size of less than 10 microns. (Author Abstract Modified)

7125 APTIC NUMBER 15132

Weller, Sol and Waldo A. Steiner
ENGINEERING ASPECTS OF SEPARATION OF GASES. FRACTIONAL PERMEATION THROUGH MEMBRANES. Chem. Eng. Progr., 46(11):585-590, Nov. 1950. 9 refs.

Many nonporous organic membranes show widely varying permeabilities toward different gases. This property can be the basis of a process for separating appropriate gas mixtures. A theory was developed for the fractionation of a binary gas mixture and then checked in a small, laboratory, single-stage unit operating on air at five atmospheres. Permeability coefficients toward a number of gases were determined for a variety of commercial packaging films. Of the films tested, ethyl cellulose seems to be most suitable for the fractionation of air, and polystyrene most suitable for the separation of helium and hydrogen from gas mixtures. Since the films are not perfectly selective, it will usually be necessary to employ a multistage, recycle system to obtain gases of high purity; in favorable cases the number of stages can be small. Application of the theory indicates that processes of potential commercial interest can be set up for the separation of oxygen from air, helium from natural gas, and hydrogen from such gases as coke-oven gas, hydrogenation tail-gas, and petroleum refinery gases. (Author abstract modified)

7126 APTIC NUMBER 13636

Whitehouse, A. G. R.
THE HEAT OF ADSORPTION OF GASES BY COAL AND CHARCOAL. J. Soc. Chem. Ind., 45:137T-207T, Jan. 15, 1926. 18 refs.

Although the adsorption of gases by charcoal and other substances has been investigated extensively during recent years, the thermal change accompanying this phenomenon has received much less attention. In view of this experiments were conducted with different types of coal and charcoal to measure the adsorption of SO2, nitrogen, methane, CO, CO2, and oxygen using specially designed adsorption apparatus and a calorimeter. The heat evolved/cc of gas absorbed decreased as more gas was absorbed; the results obtained with charcoal and the different coals were very similar. The values obtained for the heat evolved/cc of gas adsorbed were: CO2:0.346-0.255 cal; SO2:0.627-0.359 cal; methane:

0.245-0.199 cal; oxygen: 0.19-0.17 cal; nitrogen:0.22-0.17 cal; and CO:0.198-0.188 cal. An equation is given relating the total heat evolved/g of adsorbent with the total volume of gas adsorbed/g of adsorbent. The gases studied were adsorbed more slowly by coal than by charcoal; the differences were most pronounced in the cases of methane and nitrogen.

7127

APTIC NUMBER 16439

Wilde, M. P. v.
MIXED INFORMATIONS. (Vermischte Mittheilungen). Text in German. Chem. Ber., 19(1):352-357, Jan. - June 1874. 2 refs.

The production of acetylene by passing acetylene chloride through a red glowing porcelain tube can be increased by filling the tube with pieces of quicklime or soda lime. Experiments with acetylene showed that 2 volumes of acetylene (C2H2) mixed with 4 volumes of hydrogen yields 2 volumes of C2H6. Ethylene (C2H4) mixed with the same volume of hydrogen yields C2H6. In further experiments, the influence of electric current on a mixture of SO2 and oxygen as well as on ethylene and on acetylene was studied. The volume of the SO2/O2 mixture was reduced slowly in the first case. It took 5 to 6 hours to reduce 50 ccm of the gas. The two gases reacted directly with each other and SO2 was formed. Ethylene and acetylene condensated very rapidly under formation of polymers in the first case; in the latter case, an oily liquid condensated which solidified after several hours. This substance is brown and amorphous as well as insoluble. Further studies of this substance will be performed.

7128

APTIC NUMBER 16000

Wirtz, Karl
PLACE EXCHANGE PROCESSES IN LIQUIDS. (Platzwechselprozesse in Fluessigkeiten). Text in German. Z. Naturforsch., 3A(12): 672-690, 1948. 102 refs.

Each particle of a liquid changes its place constantly due to the temperature influence. The place exchange is twofold: a gradual change together with the environment; and an abrupt change relative to the immediate environment. Numerous observations point to the fact that a certain kinetic minimum energy is necessary for the abrupt place change. The expression for the frequency of such jumps contains a collision factor and a Boltzmann exponential factor. The quasi-crystalline model of liquids suggests this expression. Moreover, it indicates the average path covered by a jump. Diffusion, viscosity, ion mobility and thermal diffusion of liquids can be expressed by laws which contain the number of place exchanges of a particle per second as well as the average path length covered. The theory of the frequency of place exchanges still requires further studies. Calculation of the place exchange frequency by the transition state theory by Eyring requires special assumptions. Some problems such as interpretation of the exponential dependence of the viscosity of plastic minerals on the shaer strength by Griggs, interpretation of the influence of an outer pressure on the viscosity and on the place exchange energy, the explanation of the exponential electric field dependence on the conductivity of glasses, paraffins etc. were treated with the place exchange model for the first time.

7129

APTIC NUMBER 15818

Wood, William H.
MORPHOLINE COMPOUND AND METHOD OF PREPARATION. (Harris-Seybold-Potter Co., Cleveland, Ohio) U. S. Pat. 2,270,490. 3p., Jan. 20, 1942. (Appl. April 29, 1939, 13 claims).

A process for making a morpholine derivative was invented. Morpholine was reacted with sulfur dioxide in the absence of water. The temperature was maintained below 120 C until one-half a mole of sulfur dioxide was absorbed for each mole of morpholine. The reaction was completed below 60 C while one-half a mole of sulfur dioxide was absorbed for each mole of morpholine. At the end of the reaction, one mole of water was combined with each mole of the reaction product to form a crystalline material. These derivatives are applicable in the following areas: photographic developers, local anesthetics, and anti-oxidants.

7130

APTIC NUMBER 16235

Woolum, John C., Enzo Tiezzi, and Barry Commoner
ELECTRON SPIN RESONANCE OF IRON-NITRIC OXIDE COMPLEXES WITH AMINO ACIDS, PEPTIDES AND PROTEINS. Biochim. Biophys. Acta (Amsterdam), 160(3):311-320, 1968. 16 refs.

Ferrous iron-nitric oxide complexes with amino acids, peptides, and proteins were prepared for electron spin resonance studies by dissolving the latter in water and ascorbic acid. The pH was adjusted to 6 and NaOH or HCl and NaNO3 were added to the complexes. Signals were recorded by a spectrometer specifically designed for high sensitivity for aqueous samples. A free radical with a (g) value of 2.033 and line width of about 8 gauss was present in all reaction mixtures. Three line hyperfine resonances due to a chelate type complex and a 13 line hyperfine resonance were also observed. These hyperfine structures can be used to determine the structure of complexes made with amino acids and short peptides. The unimpaired electron of the free radical complexes formed by amino acids, iron and NO is associated to some degree with nitrogen atoms. Though amino protons do not contribute to resonance spectra, signals from iron-NO complexes formed by protein depend on the amino acid composition of the protein. If the protein is poor in SH groups, the iron-free radical complex is associated with imidazole groups in protein histidine residues. If the protein is rich in SH groups, the iron-NO free radical is formed with the SJ groups. These iron-NO protein complexes have signals similar to cysteine complexes in the frozen state. If a complex has excess iron and protein containing both imidazole and accessible SH groups, both types of signals are produced. Iron-NO free radical complexes have significant biological implications. They appear in organisms exposed to both nitrite and NO and can influence the enzymatic properties of a number of proteins.

7131 APTIC NUMBER 15798

Workman, Walter L. and Seymour Calvert
MASS TRANSFER IN SUPPORTED FROTHS. Am. Inst. Chem. Engrs. J., 12(5):867-876, Sept. 1966. 39 refs.

Operating and mass transfer characteristics are reported for a supported froth apparatus consisting of a dual-flow sieve plate column with eggcrate packing above the plate. The assembled packing produces a series of vertical tubes and supports the froth generated at the plate, increasing its heigth and consequently the contact time. The mas transfer systems studied were ammonia-air-water and carbon dioxide-air-water. The range of gas rates for which the column will operate was considerably greater than for conventional sieve trays or for the dual-flow tray operated without packing. The range of liquid rates were somewhat less than for conventional sieve trays. Thy pressure drop was considered to be the sum of an orifice effect, clear head of liquid, and the two-phase frictional loss. The pressure drop can be predicted from existing analytical expressions if a modified friction factor is applied to the two-phase frictional loss. In general, the pressure drop is comparable to other equipment. The efficiency of the supported froth equipment is better than comparable conventional sieve and bubble cap trays for gas-phase controlled systems. It is comparable for the liquid-phase controlled systems. The efficiency is definitely improved by the use of packing. A mathematical model based on measurable physical parameters in mass transfer is developed for calculating the efficiency of froth equipment. Comparison of predicted and observed mass transfer efficiences shows that the supported froth equipment is capable of producing high efficiency and a wide range of operation. Its main disadvantage is lower liquid phase efficiency, caused primarily by the low solubility of carbon dioxide.

7132 APTIC NUMBER 15938

Yiru, Pavel
EFFECT OF ALKALI METAL SULFATES ON THE ACTIVITY OF VANADIUM PENTOXIDE IN THE CATALYTIC OXIDATION OF SULFUR DIOXIDE. (Vliyaniye sul'fatov shchelochnykh metallov na aktivnost' pyatiokisi vanadiya pri kataliticheskom okislenii dvuokisi sery). Text in Russian. Sb. Statei Nauchn-Issled. Inst. Udobr. i Insektofung., 1963:21-35. 12 refs.

Studies of infrared spectra of equimolar melts of Cs2SO4-V2O5, Rb2SO4-V2O5, and K2SO4-V2O5 and thermal studies of the diagram of state for the system Cs2SO4-V2O5 have shown that, in the region of equimolar ratios of the components, new compounds called sulfovanadates are formed. In the system Cs2SO4-V2O5, a single compound with a melting point at about 440 C is formed. Between this compound and the pure components, two eutectics are found with melting points at 400 and 350 C. These equimolar melts are evaluated on the basis of infrared spectra and possible bond types are proposed for the compounds present. A probable mechanism for the action of sulfovanadates during catalytic oxidation of SO2 is formulated, and causes for differences in activity of catalysts containing various alkali metals are examined.

7133 APTIC NUMBER 16485

Young, Russell A.
LIQUID METHANE...A CHEAPER MEANS OF PEAK SHAVING? Oil Gas J., 57(13):75-82, March 23, 1959.

Current progress and development in methane gas liquefaction and storage are reviewed. Either the expander cycle or the cascade type are preferred among the numerous liquefaction processes. The expander cycle is a simple straight methane-refrigeration cycle and is more economical in small plants. The cascade cycle is similar, but in large plants refrigerants such as propane or ethane are substituted. The economics of peak load shaving are discussed. Tabular presentations of the comparative economics of peak load shaving include investment costs, fixed and direct costs, and operating cost per day sendout.

7134 APTIC NUMBER 15785

Young, R. A., Graham Black, and T. G. Slanger
REACTION AND DEACTIVATION OF O(D 1). J. Chem. Phys., 49(11):4758-4768, Dec. 1, 1968. 26 refs. (AROC Contract DA-31-124-ARO-D-446 and DA-31-124-ARO-D-434, Rept. 5134.9-P.)
AD 686018

Relative rates for quenching of O(D 1) to (P 3) and for removal of O(D 1) by reaction were measured for helium, nitrogen, argon, nitrous oxide, hydrogen, nitrogen oxide, and carbon dioxide gases. The O(D 1) was produced by photolysis of O2 at 1470 A. The rates were determined by measuring the variation of the production rate of O(P 3) atoms as a function of the amounts of quenching and reactive gases added to the system. From the limits set by the lack of detection of the 6300 A line of the O(D 1) to O(P 3) transition, and the maximum rates of two-body reactions, the rate coefficients were put on an absolute basis. Except for Ar and He, all gases measured interact with O(D 1) with rate coefficients greater or equal to 4 times 10 to the minus 11th power cu cm/molecule/sec. (Author abstract modified)

7135 APTIC NUMBER 15790

Young, R. A., Graham Black, and T. G. Slanger
VACUUM-ULTRAVIOLET PHOTOLYSIS OF N2O. I. METASTABLE SPECIES PRODUCED AT 1470 A. J. Chem. Phys., 49(11):4769-4776, Dec. 1, 1968. 25 refs. (AROD Contract DA-31-124-ARO-D-446 and DA-31-124-ARO-D-434, Rept. 5134.8-P.)
AD 686017

Various photometric techniques were used to obtain information about the reactions and quantum yields of the metastable species formed in N2O photolysis at 1470 A. The total quantum yield of atoms is 1.0; O(S 1) is produced with a quantum yield of 0.5; and O(D 1) has a measured quantum yield of 0.55, although this value may include electronically quenched O(S 1). The N2(A 3 sigma) quantum yield is 0.08, which, from spin considerations, must also be equal to the O(P 3) yield. The N2(D 2) that is

produced reacts with N2O, (apparently quite inefficiently) to give NO(B 2 pi). (Author abstract modified)

7136 APTIC NUMBER 16106

Yur'eva, T. M., G. K. Boreskov, and V. Sh. Gruver
NATURE OF THE CATALYTICALLY ACTIVE COMPONENT OF COPPER-CHROMIUM OXIDE CATALYSTS OF THE CONVERSION OF CARBON MONOXIDE. Kinetics Catalysis (USSR) (English translation from Russian of: Kinetika i Kataliz), 10(2):234-239, March-April 1969. 15 refs.

In previous investigations of the conversion of carbon monoxide by chromite catalysts, the catalytic activity of copper chromite was found to be 100 times higher than that of other chromites. In the present investigation, conducted to determine the chemical compound responsible for the high activity of the catalyst, the influence of carbon monoxide, hydrogen, or the reaction mixture on copper chromite reduction was studied. The catalytic activity of the copper chromite remained constant during the reduction process when up to 0.7 monolayer of oxygen was removed, but decreased with further removal of oxygen. When the process was carried out below 300 C for 10 hours, no decomposition of the chromite crystall lattice occurred. These results show that the initial chromite, and not the metallic copper formed from its decomposition, possesses the high catalytic activity. The catalytic properties are associated with the copper ions in the lattice of copper chromite. Comparison of the adsorption properties of copper chromite and its decomposition products, chromium oxide and metallic copper, confirmed the conclusion that high catalytic activity is characteristic of copper oxide. It is proposed that the solid solution of copper responsible for the catalytic behavior is formed during activation of the catalyst.

7137 APTIC NUMBER 16196

Yushkevich, N. P. and V. A. Karzhavin
PRODUCTION OF SULFUR FROM SULFUR DIOXIDE II. III. (Poluchenie sery iz sernistogo gaza). Text in Russian. Khim. Prom. (Moscow), 8(2):109-119, 1931. 18 refs.

The composition of the equilibrium mixture obtained by reacting sulfur dioxide with solid carbon (charcoal) was computed between temperatures of 700 C and 1200 C; calculations from experimental data showed that sulfur was not obtained in the free form in the gas phase, it was in the form of carbonyl sulfide and carbon disulfide. If water was present in the charcoal, hydrogen sulfide was also formed. The relative rates of reaction of sulfur dioxide and coke at temperatures between 500 and 1200 C were experimentally determined. To obtain sulfur in the free state, it was necessary to add sulfur dioxide or oxygen to oxidize the carbonyl sulfide and carbon disulfide. It was found that the addition of 1-1.5% sulfur dioxide in the final gas mixture was sufficient for this purpose at a temperature of 800-900 deg. Using bauxite as a catalyst, it was possible to carry out the reaction at a temperature of 500 deg.

7138 APTIC NUMBER 16202

Yushkevich, N. P. and V. A. Karzhavin
PRODUCTION OF SULFUR FROM SULFUR DIOXIDE I. (Poluchenie sery iz sernistogo gaza). Text in Russian. Khim. Prom. (Moscow), 8(1):3-14, 1931. 31 refs.

The equilibrium constant was calculated for the reaction 2 SO2 + 4CO yields 4CO2 + S2. The content of carbonyl sulfide and carbon disulfide was calculated in the equilibrium gas mixture obtained by the reduction of sulfur dioxide by carbon monoxide. The carbonyl sulfide and carbon disulfide content in the equilibrium mixture amounted to only a very small per cent in a ratio of the original mixture of sulfur dioxide to carbon monoxide of 1/2 and higher. That is, the reduction proceeded essentially according to the above equation. The equilibrium was studied experimentally at a temperature interval of 800-1100 deg. The rate of reaction of sulfur dioxide and carbon monoxide was studied in the presence of various catalysts, the most active of which were compounds of iron and aluminum. A double catalyst consisting of 20-25% Fe2O3 and 75-80% Al2O3 was the most effective. Natural bauxite was quite active.

7139 APTIC NUMBER 16022

Zalogin, N. and N. Nechaeva
THE POSSIBLE EFFECT OF WAVELENGTH OF THE HIGH-FREQUENCY DISCHARGE ON GASEOUS CHEMICAL REACTIONS. (O vozmozhnom vliyanii dliny volny vysoko-chastotnogo razyada na gazovye khimicheskie reaktsii). Text in Russian. Zh. Fiz. Khim., 6:436-44, 1935. 8 refs.

The effect was studied of wavelength on the oxidation reaction of sulfur dioxide and on the value of the logarithmic attenuation ratio in a mixture of sulfur dioxide and air. A relationship was found to exist between the logarithmic attenuation ratio and the ongoing chemical reaction. The effect was studied of the wavelength on the oxidation of sulfur dioxide in an atmosphere of pure oxygen and on the value of the logarithmic attenuation ratio in a mixture of sulfur dioxide and oxygen. This relationship differed from that obtained for oxidation of sulfur dioxide in the air. The effect was studied of wavelength on the formation of ozone in an atmosphere of oxygen and on the logarithmic attenuation ratio. An increase in the wavelength from 150 to 500 meters decreased the yield of ozone. A curve was drawn for the effect of the frequency of the high-frequency discharge on the value of the ratio in an atmosphere of nitrogen. The maximum logarithmic attenuation ratio occurred at 220 meters. The relationship was studied of the amount of nitrogen oxides formed, in a mixture of nitrogen and oxygen, on the percentage content of these gases. The optimal ratio of the reacting gases depended on the frequency of the high-frequency discharge.

7140 APTIC NUMBER 16005

Zessack, Uwe
THE COAGULATION OF MIXED DUSTS. Staub (English translation from

German of: Staub, Reinhaltung Luft), 28(11):53-60, Nov. 1968. 17 refs.
CFSTI: TT 68-50448/11

A mathematical expression of coagulation was derived for monodispersed particles and extended to spherical particles of mixed dusts. The coagulation velocity is related to the diffusion constant and the size of the coagulating samples. The intensified coagulation in the field of gravity and the influence of electrical charging of particles on coagulation are discussed. Experimental verification of the theoretical coagulation was attempted with quartz and carbon black dust, which was used as an additive aerosol. The carbon black particles captured suspended and settling quartz particles so that an entangled mas was formed. Because of its bulk, this mass presumably loses its lung penetrating capacity. At a given carbon black concentration, the number of quartz particles remaining free in the mixture decreases rapidly with coagulation time. It is concluded that when a considerable part of the free quartz surface is covered by coagulation with an innocuous additive dust, the possibility of direct quartz particle deposition on cell membranes is correspondingly reduced. In other words, particle enlargement by coagulation causes more rapid settlement outside the respiratory tract and impedes penetration of the aggregates into the pumonary alveoli.

7141 APTIC NUMBER 16348

Zikanova, A., M. M. Dubinin, and I. O. Kadlets
INVESTIGATION OF THE DYNAMICS OF THE ADSORPTION OF BENZENE BY ACTIVATED CHARCOALS WITH VARIOUS POROUS STRUCTURES AND GRAIN SIZES. COMMUNICATION 3. ANALYSIS OF THE KINETIC FACTORS IN CONNECTION WITH THE POROUS STRUCTURE ACTIVATED CHARCOALS. Bull. Acad. Sci. USSR, Chem. Ser. (English translation from Russian of: Izv. Akad. Nauk SSSR, Ser. Khim.), no. 6:1120-1126, June 1969. 7 refs.

The change in the coefficient of internal diffusion of benzene in grains of activated charcoal was evaluated as a function of the filling of the volume of the adsorption space in kinetic experiments conducted successively a four initial concentrations: C01 equals 1.1, C02 equals 3.84, C03 equals 11.7 and C04 equals 23.4 mg/l. First the kinetic curve was determined at an initial concentration, C01, and after the equilibrium state was reached, the experiment was continued with an abrupt change of the initial concentration to C02. The time of change of the concentration was considered for the second experiment, etc., in calculating the effective diffusion coefficient. The curves show that the coefficients increased regularly with increasing volume and specific surface of the transport pores (transitional and macropores). An evaluation of the role of various kinetic factors in the general mass exchange is given. Under the conditions studied, longitudinal transport and internal diffusion of the substance being adsorbed are deciding factors for the dynamics of adsorption.

7142 APTIC NUMBER 15981

Zinov'eva, A. P. and S. G. Bashkirova
CONTACTING EFFICIENCY OF HETEROGENEOUS GASES AND EXTENT OF CHEMICAL CONVERSION IN A FLUIDIZED BED. (Effektivnost' kontaktirovaniya geterogennykh faz i glubina khimicheskogo prevrashcheniya v psevdoozhizhennom slove). Text in Russian. Khim. i Tekhnol. Topliv i Masel, 12(2):1-5, Feb. 1967. 10 refs.

An attempt is made to find an analytic expression for the effec of bed height of a fluidized copper silicate contact mass and the fluidizing number, using methyl chloride. Data from the literature on the direct synthesis of alkylchlorosilanes in reactors with diameters of 45 and 30 mm are used. The effect of bed height and fluidizing number on the degree of conversion are expressed in terms of two partial relative coefficients of contact efficiency of heterogeneous phases. As bed height increases, the arbitrary contact time, which is used to define the above coefficients, increases while the surface of phase contact may decrease. Wall effects are seen as complicating factors in the macroscopic kinetics of such a system, and this significantly reduces the value of studies made on reactors of small diameter.

7143 APTIC NUMBER 16063

Abrosimova, N. M. and P. I. Tatarskaya
PROPERTIES OF ADENOSINE TRIPHOSPHATASE IN VARIOUS FRACTIONS OF FISH EGGS. (O svoisvakh adenozintrifosfatazy v razlichniykh fraktsiyakh yaits ryb). Biokhimiya, vol. 28:488-496, May-June, 1963. 8 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 20p., Sept. 30, 1969.

The enzyme activity of fish egg adenosine triphosphatase (ATPase) and the relationship of the ATPase to the Ca(2+) ion was studied. An EDTA concentration of 0.005 and higher completely removes ATPase activity of extracts from infertile sturgeon eggs. The effect of Mg(2+), Mn(2+), Ca(2+), Ba(2+), and Sr(2+) was studied in the presence of 0.001 M EDTA. All the cations demonstrated an activating effect. In protein fractions obtained by the precipitation of extracts and homogenates with (NH4)2SO4 and subsequent dialysis, ATPase activity was found only in the presence of bivalent cations. The cations, from greatest to least, according to the degree of activating effects, were arranged in the order Mn(2+), Mg(2+), Ca(2+); Sr(2+), and Ba(2+) were inactive. In spite of the presence of a quite active 5'-nucleotidase in the protein precipitates, ATPase activity could be singled out by carrying experiments at acid pH values. In the pH zone equal to 5.5 5'-nucleotidase was inactive. Subcellular fractions of 450 g, 20,000 g, and a supernatant were isolated by differential centrifugation in sucrose. Addition of bivalent cations caused the activation of ATPase; Mg(2+) ions activated more strongly than Ca(2+) ions. Data indicated that the presence of Ca(2+) ions which are required for fertilization cannot be related to their activating effect on ATPase, since neither Mn(2+) nor Mg (2+) can replace Ca(2+) in the process of fertilization. It was established that pyrophosphatase of sturgeon eggs is activated, by Mg(2+) but not Mn(2+). Thus, it was assumed that orthophosphate is split off from ATP by the action of ATPase and not pyrophosphate. The slight splitting of phosphate from ADP, established earlier, demonstrated that the ATPase of sturgeon eggs splits from ATP only one terminal phosphate. (Author summary modified)

7144 APTIC NUMBER 16065

Alekseyeva, O. G.
ANTIBODIES TO AUTOERYTHROCYTE LYSATE IN RAT DURING CHRONIC ACTIVITY OF CERTAIN RADIOACTIVE BIOELEMENTS. (Antitela k lizatu autoeritrotsitov u krys pri khronicheskom vozdeystvii nekotorykh radioaktivnykh bioelementov). Radiobiologiya, 6(5):708-711, 1966. 8 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 9p., 1969.

The production of autoantibodies in rats subjected to chronic poisoning with three radioactive bioelements was studied. Radioactive bioelements were Mn(54), S(35), and Ca(45). The wang method was used to determine antibodies to the lysate of autoerythrocytes in 217 mongrel rats. The test rats received isotopes over a period of 3 to 12 months enterally by means of an automatic drinking bowl. The control rats received stable isotopes of sulfur and calcium in equal weight quantities. Control rats for experiments with manganese (54) were subjected to external gamma radiation in doses equal to the cumulative exposure of the test animals. The reactivity of the control rats did not differ from that of the test rats. The test animals which received Ca(44) and S(35) in large doses developed clinically expressed radiation poisoning. The rats which received Mn(45) and S(35) in lower doses suffered a mild radiation reaction. The frequency and intensity of positive reactions did not increase in control animals subjected to external gamma radiation, or given stable isotopes of sulfur and calcium. In the test rats, a statistically reliable increase in frequency and degree of positive reaction was observed in three cases: early in radioactive exposure; in the first weeks of cessation of S(35) in both dosages; and in the delayed period after cessation of radioisotopes. The appearance of autoantibodies in the first weeks of radioactive influence was possibly linked with reactions of bone marrow to local radiation. It was assumed that the increase in production of antibodies to the lysate of autoerythrocytes with the introduction of radioactive bioelements was linked with the expressibility of total radiation reaction and total integrated absorbed dose, and with the exposure of definite microstructures. Adaption of the organism to this local affection permitted long-term reduction in the production of antibodies.

7145 APTIC NUMBER 16225

Amdur, Mary O.
TOXICOLOGY OF DECAY PRODUCTS OF SULFUR DIOXIDE IN THE ATMOSPHERE. Preprint, National Air Pollution Control Administration, Washington, D. C., Div. of Health Effects Research, 29p., Oct. 1969. 26 refs.

The comparative toxicity of decay products of sulfur dioxide and literature dealing with toxicology are reviewed. The guinea pig is the most sensitive species to SO2 among small laboratory animals and suitable for studying the irritant potential of low concentrations of sulfuric acid. The greater sensitivity of the guinea pig results from greater sensitivity to bronchospasm and laryngeal spasm. Sulfuric acid in sufficient quantities will cause the death of exposed animals. Sulfuric acid also causes lung pathology. There is a clear indication that the particle size of the sulfuric acid mist is an important factor in determining the irritant potency of the material. Studies of pulmonary function in animals cannot be extrapolated to predict the response of man to these substances. In considering animal experiments as indirect toxicity guidelines, two points emerge. The first is the importance of particle size of the particulate oxidation products of sulfur dioxide on the irritant potency. Data on concentration alone is insufficient to predict irritant potency. The most important size range is the submicron particle. The second important point is that the particulate oxidation products of sulfur dioxide are of a much greater irritant potency than sulfur dioxide gas. It is thus important to assess atmospheric levels of sulfur dioxide in terms of potential for formation of more irritant substances. Although definitive data are lacking, it appears that sulfuric acid produces an increase in flow resistance in human subjects. It is, however, impossible to determine at what levels of concentration such changes might be



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expected to occur, as can be done with available data on sulfur dioxide exposures. (Author summary modified)

7146 APTIC NUMBER 14596

Arkhipova, C. G.
MECHANISM OF ACTION OF THE NEW ANTIKNOCK COMPOUND MANGANESE CYCLOPENTADIENYLTRICARBONYL ON THE ORGANISM. English translation of: Gigiena Truda i Prof. Zabolevaniya (Moscow), No. 4:T51-T54, 1963. 5 refs.

It has been suggested that manganese cyclopentadienyltricarbonyl (MCT) be used as an antiknock compound in internal combustion engines to replace tetraethyl lead. Investigations which give a general description of the changes that occur in the organs and systems of organisms following the administration of MCT are reported. The compound was administered by inhalation to rabbits and white rats. Results showed that the MCT is a toxic substance of polytropic action; MCT vapor disturbs the function of the nervous system and kidneys, and reduces the osmotic resistance of the erythrocytes. It affects the normal source of the oxidation process and the processes of oxidative phosphorylation. Oxygen inhalation has favorable effect in acute MCT intoxication.

7147 APTIC NUMBER 16558

Barhad, B., M. Tai, C. Simionescu, and V. Mirea
RESPIRATORY FUNCTIONAL CAPACITY UNDER THE INFLUENCE OF DUSTS, AT REST AND AT WORK. (Capacite fonctionelle respiratoire sous l'influence des poussieres, au repos et a l'effort). Text in French. Arch. Maladies Profess. Med. Trav. Securile Sociale (Paris), 30(9):493-503, Sept. 1969. 28 refs.

The effects of inhalation of dust-bearing air was studied with 0 to 10, 10 to 25, 25 to 50, 50 to 100, more than 100, and 300 to 500 mg/cu m of cement dust with 70% of particles of less than 1 micron mean diameter, on the ventilatory capacity of 25 men, 20 to 25 years of age free of any pulmonary afflictions and never exposed to any dusts before this study, and on that of 41 miners, 30 to 45 years of age who had been working for various lengths of time before this study on the bottom of a zinc and a lead mine. Silicosis was presented in 39 of the latter in various stages of advancement, while all others were found to be free of pulmonary pathological modifications. Tests were made of the ventilatory capacity, which consisted of determining spirographic parameters, using a Godart spirograph, with and without bronchial dilatation by aleudrine; percentages of absorbed O2 and eliminated CO2; and oxyhemoglobin saturation during an exertion test. During the latter, the subject breathed dust-bearing air for 20 minutes through a respiratory mask connected by a flexible tube with an air dusting chamber the dust content of which was controlled by a tyndalloseter, the five-minute exertion test being started 5 min after the start of the dust exposure. The results of this series of tests show that the dust had a direct effect on the respiratory functions of all subjects. Among the spirographic parameters, the 'vital capacity' constitutes a sensitive indicator of the effect of dust. As long as the dust content of the inhaled air is less than 50 mg/cu m, almost one-half of the subjects react by a lowering of their vital capacity. At dust contents above 50 mg/cu m, the proportion of those with lowered vital capacity is higher, and with subjects never exposed to dust before this study, a high dust content of air (300 to 500 mg/cu m) leads to a lowering of the vital capacity of 80% of them.

7148 APTIC NUMBER 16345

Biersteker, K.
POLLUTED AIR. ORIGIN, MEDICAL SIGNIFICANCE AND COMBATING OF POLLUTED OUTSIDE AIR. (Verontreinigde Lucht. Ontstaan, medische betekenis en bestrijding van verontreinigde buitenlucht). Assen, Van Gorcum, 1966, 214p., 339 refs. Translated from Dutch. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 275p., July 29, 1969.

Factors affecting emissions are considered, together with trends in emissions in the Netherlands and Rotterdam. The qualitative and quantitative significance of air pollutants as potential disease agents in Rotterdam is evaluated. The maximum sulfur dioxide concentration so far recorded in Rotterdam is 1600 micron cu m; the maximum smoke concentration, 500 micron/cu m. No epidemiological significance is attributed to measured concentrations of fluorides, nitrogen dioxide, carbon monoxide, or lead. Concern is shown for the role of benzpyrene and other carcinogens in the etiology of lung cancer. Distinctions are made between acute, sub-acute, and chronic air pollution. During acute air pollution, SO2 and smoke concentrations in Rotterdam show five-fold increases. Sub-acute pollution occurs when wind speeds drop below 2 m/sec. Chronic air pollution is present on all other days, especially in winter. Though the effects of pollution can also be categorized as chronic, acute, and sub-acute, the level of air pollution is still too weak to cause illness. Methodologies employed in determining the relationship between air pollution and human mortality and morbidity are reviewed, and hypotheses developed to describe the effects of pollution on illness and death in Rotterdam. Refinements in analytical methods are urged so that the factors influencing increased chronic non-specific lung disease mortality and lung cancer mortality can be identified. It is also suggested that emission standards be supplemented by regulations making it possible to restrict emissions when meteorological data and monitoring station readings point to certain dangers.

7149 APTIC NUMBER 16707

Blair, William H., Mary C. Henry, and Richard Ehrlich
CHRONIC TOXICITY OF NITROGEN DIOXIDE. II. EFFECT ON HISTOPATHOLOGY OF LUNG TISSUE. Arch. Environ. Health, 18(2):186-192, Feb. 1969. 9 refs.

Mice were exposed to 0.5 ppm nitrogen dioxide (NO2) for 6, 18, and 24 hrs. daily. The lung alveoli were expanded in all mice exposed to NO2 from three to twelve months, with the highest degree of involvement at 12 months; thus the number of expanded alveoli appeared to increase with exposure time. The general impression

was of early bronchiolar inflammation with reduction of distal airway size and a concomitant expansion of alveoli. The overall lesions appeared to be consistent with the development of early focal emphysema. Examination of the heart, liver, kidney, and spleen did not reveal any unique pathology. Mice exposed to NO2 and challenged with Klebsiella pneumoniae exhibited a marked reduction in functional lung tissue. (Author's Abstract)

7150 APTIC NUMBER 16497

Cascone, A. and R. Malusardi
MYOCARDIAL INFARCT WITH ALLERGIC PATHOGENESIS. DESCRIPTION OF ONE CASE. (Infarto miocardico a patogenesi allergica. Descrizione di un caso.). Text in Italian. Minerva Cardioangiologica, 16(11):1161-1166, Nov. 1968. 20 refs.

A 23-year-old worker in a chemical plant had duties that brought him in contact with sulfur dioxide. In November 1961, he was admitted to a hospital in Milan, was given a diagnosis of asthmatic bronchitis of chemical origin, and was advised to change his occupational environment. In April 1963, he returned to the same plant, where he again contacted the SO2 vapors. Within a few hours he was seized with a violent retrosternal pain accompanied by moderate dyspnea. He was again hospitalized and treated with corticosteroids and calcium hyposulfite. Electrocardiographic examinations indicated the normal pattern following an infarction. The patient was discharged after 35 days of hospitalization and resumed work without further complaints. An allergic origin of the heart attack can be argued from the fact that the patient was only 23 years of age, that the first exposure to SO2 caused bronchial asthma, that the infarct did not involve the respiratory apparatus, that shock symptoms were absent, that an excess of gamma globulin and eosinophilia were found during the acute phase of the attack, and the short time of fresh exposure to the allergen before the appearance of the coronary symptoms. The case underscores the importance of the anaphylactic phenomenon in coronary and myocardial illnesses.

7151 APTIC NUMBER 16047

Chaneles, J.
ACTION OF IODINE ON CHRONIC FLUOROSIS. (Action de l'iode sur la fluorose chronique). Compt. Rend., vol. 102:863, 1929. Translated from French. Public Health Service, Air Pollution Technical Information Center, 2p., Sept. 15, 1969.

Four groups of five rats each were subjected to a diet of bread and milk for 6 months. The rats in the first group were fed 50 mg/kg sodium fluoride per day; the second group, 2 mg sodium iodide per animal; the third group, fluoride and iodide at the same time; and the fourth group received neither of these substances. The growth of rats receiving fluorine was better than that of the control group for 3 months, then slackened, and on the sixth month was less. The hair was less silky and blood marks appeared at the nostrils and on the vagina. The rats that were iodized and fluoridized had the same symptoms, but more accentuated. Iodide given alone favored growth. The teeth of fluoridized rats had uniform whiteness and marked elongation of superior incisors. The enamel presented undulated prisms and numerous Retzius brown streaks; superficial pigmentation was completely lacking. In the group receiving fluoride and iodide, the alterations were less marked; the teeth were more compact. Bones and organs were also studied, but noted modifications were not substantial.

7152 APTIC NUMBER 16130

Chiaramonte, Lawerence T., Joseph R. Bongiorno, Richard Brown, and Maria T. Leano
AIR POLLUTION AND OBSTRUCTIVE RESPIRATORY DISEASE IN CHILDREN. N. Y. State J. Med., 70(3):394-398, Feb. 1, 1970. 15 refs.

High levels of atmospheric sulfur dioxide occurred in Brooklyn during a period of low wind velocity and temperature inversion. During a three-week period, including the week preceding and the week following the pollution episode, 83 children with respiratory symptoms out of 420 who visited a pediatric emergency room were examined. Forty of the 83 children completed allergy evaluations. Most children had allergic constitutions, but those who visited during the period of pollution showed a lower skin reactivity to molds. There was a statistically significant rise in obstructive respiratory symptoms during the several days of high sulfur dioxide levels as compared with the days preceding and following the pollution episode (p less than 0.005). This rise was more evident on two consecutive days, seventy-two hours following the peak sulfur dioxide level (p less than 0.001 and less than 0.02). (Author summary modified)

7153 APTIC NUMBER 15579

Coffin, David L. and Earl J. Blumer
ALTERATION OF THE PATHOGENIC ROLE OF STREPTOCOCCI GROUP C IN MICE CONFERRED BY PREVIOUS EXPOSURE TO OZONE. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 10p., 1969. 13 refs. (Presented at the International Symposium Aerobiology, Third, Sussex University, Brighton, England, Sept. 15-19, 1969.)

To obtain data on the influence of ozone on clearance rate, bacterial growth, and mortality, pathogen-free mice approximately 20 days old, were divided into two groups, one of which was exposed to ozone for three hours. After the ozone exposure, both groups were exposed to an aerosol consisting of diluted Group C streptococci following which the clearance rate, bacterial growth, and mortality studies were conducted. A marked decline in the number of cultivable organisms followed the introduction of pathogenic streptococci in mice not exposed to ozone. Three-hour exposure to 1-5 ppm ozone increased the number of organisms cultivable at four hours. At levels of 0.11 ppm or below, bacterial counts for the ozone treatments could not be distinguished from the controls. Beyond four hours after aerosol exposure, marked variability in the number of cultivable cells was noted mice except those exposed to the highest ozone concentrations with ther mortalities approached 100%. It is concluded that exposure of mice to ozone increases

the possibility of death from subsequent infection by aerosolized streptococci. Associated with the increased mortality is prolonged retention of intrapulmonary bacterial viability, a shortening of the lag phase, and an increased rate of bacterial multiplication. The diminished lag phase and enhanced bacterial growth contribute to the slowing of the so-called bacterial clearance rate. Bacterial invasion of the blood appears to take place from two to four days inclusively and equates with subsequent mortality. Bacteria present in the blood are in insufficient numbers to appreciably affect the total lung counts.

7154 APTIC NUMBER 16048

Eiso, Kh. A.
ON THE CLINICAL PECULIARITIES OF MANGANESE POISONING IN ELECTRIC WELDERS. (O klinicheskikh osoennostyakh intoksikatsii margantsem u epektrosvarshchikov). Gigiena Truda i Prof. Zabolevaniya, vol. 10:39-41, April 1966. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 7p., May 19, 1969.

Thirty-two cases of manganese poisoning were observed in electrical welders active in shipbuilding yards. This included 8 cases of second degree poisoning and 2 cases of third degree poisoning. Two case histories were presented as an illustration of the disease. The presented data shows the unsatisfactory working conditions for some of the electrical welders, as well as insufficient periodic medical examinations for this type of work. Due to the possibility that manganese poisoning may be progressive, it was required that individuals showing early forms of chronic poisoning be removed from a welding job. (Author summary modified)

7155 APTIC NUMBER 13455

Gaensler, Edward A. and Whitney W. Addington
ASBESTOS OR FERRUGINOUS BODIES. New England J. Med., 280(9):488-492, Feb. 1969. 27 refs.

The incidence of asbestos pneumoconiosis (asbestosis) and asbestos-related neoplasms has increased alarmingly, due to the rapidly rising use of asbestos in industry with inadequate controls. The current concepts of asbestos bodies found in asbestosis are reviewed. Asbestos bodies are yellowish rods coated with ferritine granules and are found within the aveoli. Many other substances have been found to produce bodies of similar appearance but without a core of asbestos. These should all be labeled ferruginous bodies until further study is done. Core sources are found in urban atmosphere and are possibly emitted from automobile braking linings. Prevalence of such bodies is from 26-98% in post-mortem material, but there was found to be no relation between the number of bodies found and the severity of asbestos pneumoconiosis.

7156 APTIC NUMBER 16010

Glasser, Marvin and Leonard Greenburg
AIR POLLUTION, MORTALITY, AND WEATHER. NEW YORK CITY, 1960-1964. Preprint, American Public Health Assoc., Philadelphia, Pa., Epidemiology Section, 31p., Oct. 27, 1969. 6 refs. (Presented at the American Public Health Association, 97th Annual Meeting, Philadelphia, Nov. 11, 1969.)

Daily deaths for the years 1960-1964 in New York City (excluding April-Sept.) were studied in relation to sulfur dioxide, smoke shade, temperature deviations from normal, wind speed, sky cover, and rainfall. In order to eliminate seasonal effects, deaths were expressed as deviations from a 5 year normal. SO2 was found to be related to mortality to a greater degree when smoke shade was held constant than was smoke shade when SO2 was held constant. SO2 was, therefore, used as an index of air pollution. SO2 was found to be positively associated with mortality, independent of the weather factors studied. The evidence suggests that this increase in mortality was associated with an increase of SO2 at all levels. The difference in the mean number of daily deaths on days with mean SO2 levels of 0.20 ppm or less compared with days having mean SO2 levels of 0.40 ppm or more is estimated to be in the range of 10 to 20 deaths per day. (Author summary modified)

7157 APTIC NUMBER 16194

Gol'dberg, M. S. and Yu. G. Fel'dman
SANITARY PROTECTION OF THE AIR BASIN IN REGIONS OF INDUSTRIAL COMPLEXES. (Sanitarnaya okhrana vozdushnogo basseyna v rayonakh prosyshlennykh kompleksov). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2 Kiev, Bodivel'nik, 1968, p. 1-14.

Health hazards from large industrial pollution sources are discussed in general terms. A so-called sanitary protection zone 10-15 km wide around industrial complexes producing 6-12 million tons of steel per year is recommended. The same holds for large chemical and petroleum complexes. It is noted that existing norms (SN 245-63) established sanitary protection zones which are half those set forth in 1947. This situation is deemed unjustifiable.

7158 APTIC NUMBER 16321

Goldsmith, John R. and Robert J. Fallat
PROSPECTS FOR THE PREVENTION OF DISABLING PULMONARY DISEASE. Milbank Mem. Fund Quart., 47(3):235-249, July 1969. 13 refs.

Factors in the natural history of emphysema and bronchitis are reviewed, and preventive strategies proposed. As a group, these diseases are a cause of disability second only to heart disease; in almost one-third of the cases, the diagnosis is not established until the patient is sick enough to enter a hospital. The role of cigarette smoking in chronic bronchitis and emphysema is extremely important. However, methods for preventing its effects are neither well developed nor effectively applied. Under some

circumstances air pollution and occupational exposure are factors that contribute to excess morbidity and mortality. Anatomic emphysema, for example, is likely to be more advanced in St. Louis, a city with a relatively greater community air pollution, than in Winnipeg, which has less pollution. Evidence of a genetic basis for pulmonary disease was recently obtained with the identification of alpha 1 antitrypsin deficiency. This deficiency is transmitted as an autosomal codominant gene; homozygotes for the deficiency gene have very low serum antitrypsin concentrations and frequently develop well-defined emphysema at an early age. Persons with this deficiency should be counselled not to smoke and should not be exposed to domestic or urban pollution. The control of community air pollution is of particular importance for cigarette smokers, persons exposed to high industrial concentrations, and persons with the familial deficiency.

7159 APTIC NUMBER 16614

Greenbaum, R., J. Bay, M. D. Hargreaves, M. I. Kain, G. R. Kelman, J. F. Nunn, C. Prys-Roberts, and K. Siebold
EFFECTS OF HIGHER OXIDES OF NITROGEN ON THE ANAESTHETIZED DOG.
Brit. J. Anaesthesia, vol. 39:393-404, May 1967. 19 refs.

The physiological derangements during and after the administration of nitrogen oxides were studied in dogs anaesthetized with pentobarbitone. The dogs were exposed to concentrations of nitric oxide or nitrogen dioxide between 0.1-2.0% over 5-136 minute periods. Despite the inhalation of 98% oxygen, death was always associated with a critical reduction in arterial oxygen content. However, the mechanism of the hypoxemia varied between one dog and another. Three mechanisms were distinguished. Methemoglobinemia caused a reduction in blood oxygen capacity which was incompatible with life in certain dogs. Low arterial P(02) was sufficient to cause a serious and probably lethal reduction of arterial oxygen content in some dogs, even if the pH was normal and methemoglobinemia was absent. Low arterial pH played an important part in the causation of diminished arterial oxygen content. At normal arterial P(02), a moderate acidemia does not cause significant desaturation because of the flatness of the oxyhemoglobin dissociation curve in that region. However, if the arterial P(02) is within the range of 15-30 mm Hg where the oxyhemoglobin dissociation curve is steep, a moderate acidemia causes a marked, and possibly critical, reduction of arterial saturation and content. The reduction of arterial P(02) was caused by an outpouring of fluid into the alveoli. The causation of alveolar flooding may be related to both passive transudation and the cellular response to the acid formed by the action of nitrogen dioxide on the alveolar lining fluid.

7160 APTIC NUMBER 16709

Gross, Paul, Robert T. P. deTreville, Ethel B. Tolker, Marianne Kaschak, and Mary Ann Babyak
THE PULMONARY MACROPHAGE RESPONSE TO IRRITANTS. AN ATTEMPT AT QUANTITATION. Arch. Environ. Health, 18(2):178-185, Feb. 1969. 5 refs.

Relatively large dust burdens were imposed on the lungs of rats and hamsters by inhalation and by intratracheal injection, respectively. Three dusts with an average diameter of about 1 micron were employed with and without mineral oil injected intratracheally subsequently: Silicon dioxide (Si02(quartz)), ferric oxide (Fe203), and antimony trioxide (Sb203). Pulmonary macrophage counts by the saline washout method were made prior to and immediately following the imposition of the lung dust burden, as well as 1, 4, 7, 14, and 30 days later. Many of the recovered cells were leukocytes. After a statistical evaluation of the results, it was concluded that the number of lung macrophages recoverable by the saline washout method is dependent upon factors that cannot be regulated, nor can their effects be estimated, and that interpretations based upon the numbers of lung macrophages so obtained are, therefore, subject to pitfalls. (Author's Abstract)

7161 APTIC NUMBER 16302

Guillerm, Roger, Rene Badre, Jean Mee, and Claude Mazoule
EFFECT OF LIGHT ATMOSPHERIC IONS ON THE CILIARY ACTIVITY OF THE TRACHEAL MUCOUS OF SHEEP AND RABBIT IN VITRO. (Effets des ions legers atmospheriques sur l'activite ciliare de la muqueuse tracheale de Mouton et de Lapin in vitro). Text in French.
C R Acad. Sci., Paris, Ser. D, vol. 262:699-671, Feb. 7, 1966.
4 refs.

A section of sheep trachea, freshly excised and placed in a thermostatic environment, was swept by a 2 l/min current of water-saturated air. Ciliary activity was microscopically observed. Neither positive ions nor negative ions in this air current had any effect on ciliary vibration. Similar results were obtained with rabbit trachea.

7162 APTIC NUMBER 16192

Gusev, M. I. and K. I. Akulov
COMPLEX HYGIENIC EVALUATION OF AIR POLLUTION IN CITIES OF THE RSFSR. (Kompleksnaya gigiyenicheskaya otsenka atmosfernykh zagryazneniy v gorodakh RSFSR). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2 Kiev, Budivel'nik, 1968, p. 7-11, 4 refs.

A total of 106 million rubles was spent from 1958-1966 to set up 7827 gas collecting installations and 138 laboratories to deal with air pollution in the Russian Soviet Federated Socialist Republic. Studies of emissions from State Regional Electric Power Stations with chimneys 120-180 meters tall showed that maximum permissible concentrations of pollutants were not exceeded beyond distances of 15 km. Adverse effects on elementary school children within these areas have been verified. Work is being done by the Erisman Hygiene Research Institute in Moscow to establish the nature and degree of pollution from a number of industrial chemical sources and their effects on residents living nearby. Work done in 1965 at the Ufimovskiy Labor Hygiene and Professional Illness Research Institute is reviewed. Studies of the ferrous metallurgy industry done by the Erisman Institute are also noted. Joint planning by the Erisman Institute and the Central City-Planning

Institute for multiple dwellings in Moscow and Volgograd examined the problem of motor vehicle exhaust.

7163 APTIC NUMBER 12276

Gusev, I. S.
COMPARATIVE TOXICITY STUDIES OF BENZENE, TOLUOL, AND XYLOL BY THE REFLEX ACTIVITY METHOD. In: The Biolcgical Effects and Hygienic Importance of Atmospheric Pollutants, Book 10. Translated from Russian by B. S. Levine, U.S.S.R. Literature on Air Pollution Occupational Diseases, Vol. 17, pp. 60-67, 1968.
CFSTI: PB 180522T

The odor threshold and the effect on brain electropotentials of benzene, toluene, and zylene were determined. Experimental methods used are described. The author proposes the following conclusions: (1) Odor perception thresholds decreased with increase in the number of methyl groups in the benzene ring. Odor thresholds were: 2.8 mg/cu m benzene; 1.5 mg/cu m toluene; and 0.6 mg/cu m xylene. (2) Concentraticns of odor perception thresholds used as indexes in evaluating effects on cerebral electrical activity decreased benzene, toluol, xylol in the following order: (3) Benzene and tcluol enhanced the electrical potentials, while xylol had the opposite effect, causing a decrease in the electrical activity of the cerebral cortex. Return to normal electrical brain activity in toluol and xylol poisoning proceeded slowly. (4) 1.5 mg/cu m of benzene, 0.6 mg/cu m of tcluol, and 0.2 mg/cu m of xylol are subthreshold corcentrations as shown by results of electrical potential brain tests. These concentrations are recommended as maximal permissible single-exposure concentrations for atmospheric air. (Author's conclusion, modified)##

7164 APTIC NUMBER 16018

Heller, Morris L., T. Richard Watson, Jr., and Denis S. Imredy
EFFECT OF NITROUS OXIDE UPTAKE ON ARTERIAL OXYGENATION.
Anesthesiology, 28(5):904-913, Sept.-Oct. 1967. 15 refs.

The uptake (absorption) of nitrous oxide is a continuous process during all phases of respiration, and results in an increased inflow of ambient gas from the outside. Evidence of this ventilatory mass flow down the airway was obtained by monitoring the arterial P(02) of 17 surgical patients during apnea while nitrous oxide was extracted from the alveoli into the pulmonary circulation. With the extraction of nitrcus oxide molecules from the alveoli, the intrapulmonary pressure falls and a physiological pressure gradient is established. Compensation then occurs with the additional inflow of gas from the airway opening. During apnea and the uptake phase of nitrous oxide, the arterial P(02) varies with the oxygen concentration in the external reservoir. Extremely high arterial P(02) values were noted when apnea was instituted during early induction (two minutes), and the airway was in continuity with an oxygen environment. Lesser P(02) values were found after a ten minute N2O inductiom. When the lung contains air, a steady state exists, and no pressure gradient follows. The effect of uptake of one gas on other gases in the inhaled mixture was shown by actual P(02) measurements. The physiological mechanism responsible for the pressure gradient during nitrous oxide uptake differs from the mass flow observed during conventional apneic oxygenation. The need for high flows of nitrous oxide and oxygen during the induction period was emphasized. The micro-catheter oxygen electrode produced continous P(O2) information unobtainable with serial isolated blood samples measured singly for oxygen tension. Cyclic changes in arterial oxygen tension were observed which were synchronous with respiration. (Author summary modified)

7165 APTIC NUMBER 16165

Holland, Walter W., Tony Halil, A. Edward Bennett, and Alfred Elliott
INDICATIONS FOR MEASURES TO BE TAKEN IN CHILDHOOD TO PREVENT CHRONIC RESPIRATORY DISEASE. Milbank Mem. Fund Quart., 47(3): 215-227, July 1969. 16 refs.

A study of the symptoms of respiratory disease was carried out among school children of different ages in four areas of Kent. Supplementary information was provided by a questionnaire completed by the parents. The evidence provided by this survey, taken in conjunction with that used in an earlier study of smoking habits, enabled the identification and evaluation of the different environmental factors contributing to the development of respiratory disease in childhood. Smoking habits and area of residence are found to be of overriding importance. Anti-smoking propaganda that concentrates on the immediately harmful effects of smoking has been found to be persuasive; variation among areas is attributable to a large extent to different levels of air pollution. Suggestions are, therefore, made for the elimination of the harmful effects of both major factors. Attacks of bronchitis and pneumonia in childhood are found to have a more lasting effect on health in adult life than was previously thought, and it is suggested that these conditions should in future be regarded more seriously. (Author summary modified)

7166 APTIC NUMBER 16706

Holma, Bo
THE ACUTE EFFECT OF CIGARETTE SMOKE ON THE INITIAL COURSE OF LUNG CLEARANCE IN RABBITS. Arch. Environ. Health, 18(2):171-173, Feb. 1969. 7 refs.

The acute effect of cigarette smoke in living rabbits, inhaled in puffs which were proportional to those of man on the initial course of lung clearance, is studied by registering the elimination of an inhaled radioactive chromium (51Cr)-tagged test aerosol composed of 7 micron polystyrene particles. The result shows a significant decrease in this lung function in comparison with a control group. (Author's Abstract)

7167 APTIC NUMBER 16515

Hylyi, M. F., D. O. Melnychuk, and M. D. Klymenko
EFFECTS OF SODIUM BICARBONATE, MN(2+), MG(2+) AND ZN(2+) ON THE

INTENSITY OF THE RENEWAL OF PROTEINS, GLYCOGEN AND LIPIDS IN THE LIVER AND MUSCLES IN RABBITS. (Vplyv biccarbonatu natriiu, Mn(2+), Mg(2+) i Zn(2+) na intensyvnist onovlenniia bilkiv, hlikohenu ta lipidiv u pechintsi ta m'iazakh kr-liv). Ukr. Biokhim. Zh., 40(2):167-172, 1968. 19 refs. Translated from Ukranian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 9p., Sept. 19, 1969.

Studies of the influence of sodium bicarbonate and the bivalent metal ions Mg(2+), Mn(2+), and Zn(2+) substances favorable to CO2 fixation processes in animal tissue, on the intensity of the renewal of proteins, glycogen, and lipids of the liver and muscles of rabbits are reported. Male rabbits were fed a diet of sodium bicarbonate and sulfuric acid salts of the indicated metals for ten days. The diet caused no noticeable changes in the interrelation of dry substance, lipids, glycogen, and proteins in the liver and muscle tissues. Among changes in the intensity of metabolic processes in substances was the considerable removal of carbohydrates in liver and muscles; this was manifested by the rapid inclusion of acetate-2-C 14 in glycogen and its exclusion. There was a considerable activation of the inclusion of radioactive carbon the tissue proteins, especially in muscle protein. It is concluded that the stimulation of carboxylation processes visibly activates the renovation of carbohydrates and the intensity of the incorporation of radioactivity of protein. Lipid metabolism is influenced to a lesser degree.

7168 APTIC NUMBER 16136

Ishizaki, Tatsushi
SYMPOSIUM ON ASTHMA. EFFECT OF AIR POLLUTION UPON BRONCHIAL ASTHMA. (Shinpojyumu---Zensoku). Text in Japanese. Nippon Naika Gakkai Zasshi (Tokyo), 58(12):1287-1292, Dec. 10, 1969. 23 refs.

Presumable causes of asthmatic attacks are allergy response, disease of the trachea, and a combination of physical and mental factors. In actual fact, these factors are not inseparable: each contributes to the resistance against inhaled antibodies and each is highly sensitive to chemical mediators isolated from cells under the influence of antibody compounds. For this reasons, bronchial asthma is characterized by a constitutional predisposition to allergy response, i.e., an inclination to produce a resistance 'factor' against an antibody. The present study centers on the relationship between the resistance factor and the sensitivity to chemical mediators and air pollution. Asthmatic attacks were found to be closely related to weather conditions: more were observed on rainy days and during unseasonable weather than on fine days. The risk of attacks increased when the temperature declined 3 C below that of the previous day. Another finding was that SO2 inhalation increased stimulation through the vagii. Asthmatic patients were more sensitive to SO2 inhalation than healthy persons. In some patients, bronchoconstriction was eased by atropine injections. Today chronic bronchitis is generally used as a determinant index to the effect of air pollution on asthmatic patients: air pollution is considered to influence asthma with respect to an infection factor. It is not definitely known, however, whether air pollution results in bronchial asthma.

7169 APTIC NUMBER 16168

Ivakhno, G. I.
ON THE ETIOLOGY OF BRONCHOPULMONARY CANCER. (K voprosu o'etiologii bronkholegochnogo raka). Text in Russian. Vrachebnoe Delo (Kiev), no. 11:84-86, 1969. 11 refs.

An analysis of a special questionnaire with data on 130 urban males suffering from bronchopulmonary cancer and 130 control persons indicated the statistical validity of several etiological factors of the disease. The etiological factors found were air pollution from smoke, dust, and gases; cigarette smoking; and a precedence of inflammatory diseases in the respiratory organs. Measures are suggested to fight these phenomena for the prevention of bronchopulmonary cancer. (Author summary modified)

7170 APTIC NUMBER 12175

L. S. Jaffe
REVIEW ON CHEMICAL MUTAGENESIS. Preprint, Public Health Service, Washington, D. C., Div. of Air Pollution, ([10])p., Oct. 4, 1963. 19 refs.

Chemical mutagenesis is the process whereby the somatic cells of an organism are induced to produce a change (mutation) by chemical means or by exposure to chemical substances, wherein as a result of this exposure the cell themselves or the daughter cells, formed upon dividings, function less efficiently or differently from the parent cells. In chemical mutagenesis we are concerned with the influence of certain chemicals found in air pollution to form deleterious mutations in the somatic cells of the individual (or animal population) causing it to age more quickly; to change the appearance and nature of the cells anatomically or in function; or to act carcinogenetically and form cancers in the organism. The prime effects of chemical cancers mutagenesis are of three broad categories: (1) a change in the aging process induced by chemical means; (2) change in the nature and ajpearance of the cell and/or its function (metaplasia); (3) carcinogenesis.##

7171 APTIC NUMBER 16441

Inst. of Public Health, Tokyo, Japan
HEALTH ASPECTS OF AIR POLLUTION. In: Outline of Study of Air Pollution in Japan. Japan Air Pollution Panel, 2p., 1965. (Presented at the U. S. - Japanese Conference on the Development and Utilization of Natural Resources, 1965.)

Studies being conducted on the diffusion of air pollution, measurement methods, monitoring methods, and the effects of air pollution on human health were reviewed. An automatic filter paper sampler was invented to measure and monitor pollutants. The relationship between changes in air pollution and wind velocity and solar radiation and between vertical distribution of pollutants and meterological conditions were investigated.

Experiments were conducted on dogs to determine the effects of sulfur dioxide and nitrogen dioxide on respiratory function. It was observed that SO2 in low concentrations has only an irritant effect, but NO2 in low concentrations affects the respiratory system. An epidemiological study was conducted on school pupils in Tokyo. The results showed that there is an increase in respiratory flow resistance in pupils in polluted areas. The effects of pollutants on pulmonary mechanisms and hematology is being determined. The size-distribution of particle composition and the mutual effects among particles and gases are also being studied.

7172

APTIC NUMBER 16153

Jonas, J.
OWN EXPERIENCES WITH AIR-CONTAMINATION BY SULPHUR DIOXIDE IN PAPER-MILLS AND THEIR ENVIRONMENT. (Nase zkusenosti se zamorenim ovzdusi kysliciniem siricity v papirnach a jejich okoli). Text in Czech. Pracovni Lekar. (Prague), 21(7):318-323, 1969. 8 refs.

Considerable SO2 escapes into the surrounding atmosphere in one of the largest paper mills of Czechoslovakia, located in a deep valley where there is poor movement of air as the result of the production of pulp by the acid method and to the burning of high-sulfur content fuel. The SO2 level sometimes exceeds the legal threshold concentration of 0.5 mg/cu m and permissable daytime concentration of 0.15 mg/cu m. During the past six years there were 3 deaths due to SO2 poisoning and a case of acute intoxication resulting in a chronic respiratory disorder. Those living in the vicinity of the factory have a high incidence of cardiorespiratory disorders. Steps taken to improve the situation include a prohibition on the burning of sulfice waste materials and fuels with a high sulfur content. It is further recommended that head masks be restricted or alternated with mouth masks, so that workers will be more aware of increased SO2 concentration. A revision is recommended of the provisions concerning fines and penalties, which give no consideration to the area in the vicinity of the factory smokestack. However, SO2 manufacturing is not considered a dangerous situation, since the company is detecting respiratory illnesses before the damage became irreparable.

7173

APTIC NUMBER 16064

Kawahata, Koretoki
ON LUNG CANCER OF INDUSTRIAL ORIGIN AMONG GENERATOR-GAS WORKERS IN STEEL PLANTS. Gann (Japan. J. Cancer Res.), vol. 32: 367-387, 1938. 23 refs. Translated from Japanese. National Institutes of Health, Bethesda, Md., Div. of Research Services, 29p., Feb. 16, 1969.

The occurrence of lung cancer among generator-gas workers in steel plants was discussed. Twenty one cases of lung cancer were observed in 6 years and the case histories were given. The workers were exposed to sudden spurts of flaming gas and thick dust. The gas which is inhaled contains gaseous or powdered tar, a carcinogenic substance. Data showed that the cancer patient has a mean length of service of 16 years. The symptoms of lung cancer are insidious and become manifest only in the last stage. Complaints of coughing, a feeling of suffocation, a pain in the side, expectoration, or dyspnea make X-ray examination essential. Early X-ray examinations permit cancer to be discovered in its early stages. Metastasis to the brain, spinal cord, and lymph nodes in various localities can occur very early, while the primary focus in the lung remains undetected. Lung cancer is the same type as bronchial carcinoma or lobar carcinoma, and or sometimes disseminated cancer. Bronchial carcinoma has pressure symptoms on the part of the mediastinum. Lobar carcinoma progresses initially without signs, although the manifestation of the metastasis may stand in the foreground. The course of lung cancer is very brief; 7 months on the average. It was assumed from the evidence that lung cancer is of industrial origin for the generator-gas workers. Numerous cases were found in a specific work station where the workers inhale the gas containing the carcinogenic substance. Prevention would be achieved by improving the gas-production apparatus and improved working conditions. (Author summary modified)

7174

APTIC NUMBER 16382

Kehoe, Robert A.
CRITERIA FOR HUMAN SAFETY FROM THE CONTAMINATION OF THE AMBIENT ATMOSPHERE WITH LEAD. Proc. Intern. Congr. Occupational Health, 15th, Vienna, 1966, vol. 3:83-98, Sept. 19-24, 1966. 3 refs.

In an attempt to appraise the quantities and significance of lead in the ambient air, laboratory experiments were initiated for following the respiratory intake and output of airborne lead on the background of alimentary intake and output. In a preliminary experiment, two human subjects were observed daily for over a year for their metabolic pattern of lead intake from food and beverages and output in feces and urine. They were then exposed to air containing 150 micrograms/cu m of lead as the sesquioxide in particles ranging up to 0.18 micron diameter and having 0.05 micron mean diameter. Starting with an exposure period of 16 weeks for 10.5 hours weekly, the period was increased by 10.5 hours every 16 weeks. During each successive 16-week period of constant exposure conditions, the concentration of lead in urine and blood rose to a certain point and then continued at an essentially constant level; each incremental increase in the weekly duration of the exposure lead to a further increase of the same proportions in the output and concentration of lead in the urine and in the concentration in the blood. A line connecting the points representing the final blood concentration levels was extended to a point corresponded to continuous exposure (168 hours weekly). It is noted that, although intermittent exposure at a certain level results in an equilibrated response, this factor is inoperative under conditions of continuous exposure from the general environment. Human safety, therefore, lies in the avoidance of a persistent level of alimentary and respiratory dosage that will result in a measurable accumulation of lead in the bodies of exposed persons during a lifetime. Final results from further experiments, involving respiratory exposure to 10 micrograms/cu m of lead, are not yet available. However, it is concluded that the physiological response to graduated severity of exposure,

measured by lead excretion in urine and lead concentration in the blood, is a reliable criterion for measuring lead absorption.

7175 APTIC NUMBER 16524

Kimura, Kikuzi
EXPERIMENTAL STUDIES ON THE AEROSOL DEPOSITION IN THE HUMAN RESPIRATORY SYSTEM. (REP. 1). (Ganzozoru no kokyu kidochin chalku nikansuru kenkyu (dai 1 poh)). Text in Japanese. Rodo Kagaku (J. Sci. Labour, Tokyo), 46(2):53-72, 1970. 33 refs.

The condition of deposition of inhaled aerosol particles in the respiratory tract was determined by the simultaneous recording of changes in concentration of polystyrene and polyvinyl toluene latex aerosol particles and of carbon dioxide corresponding to respiratory air flow curve. Results of the test indicate that the deposition rate is more closely related to tidal volume than to respiration rate. It is presumed that there can be considerable individual differences in aerosol deposition among workers according to the intensity of work or the conditions of breathing. The individual differences among test subjects amounted to 10% under similar inhalation conditions. (Author abstract modified)

7176 APTIC NUMBER 16155

Krueger, A. P.
PRELIMINARY CONSIDERATION OF THE BIOLOGICAL SIGNIFICANCE OF AIR IONS. Scientiae, 54(689-690):460-476, Sept.-Oct. 1969. 34 refs.

The biological activity of air ions was investigated over a six-year period by observing changes in blood level of 5-hydroxytryptamine (serotonin-5HT) in mice during exposure to positive and negative charges of unipolar air. The experiments were conducted in plexiglas exposure chambers on which tritium-powered generators were mounted, equipped with a rectifying circuit for selection of ion charge. When air ion densities were between 400,000-500,000 negative ions/cu cm, blood 5HT decreased. With equal concentrations of positive ions, blood 5HT increased. The experimental results are compatible with physical theories which indicate that specific physiological reactions are due to small air ions and predict that positive ionization of air containing water vapor results in the formation of the oxonium ion, H(+)(H2O), and the hydronium ion, (H3O)(+)(H2O)n while negative ionization produces O2(-)(H2O)n and OH(-)(H2O)n ions. These four ions are assumed to be responsible for the shifts in blood 5HT levels. Other experiments on the mechanisms of air ions are reviewed, and data on air ions are discussed in terms of their applications for the control of the individual living and working microenvironment, the treatment of disease, and the enhancement of food production.

7177 APTIC NUMBER 16113

Kuroda, S. and K. Kawahata
ON THE OCCUPATIONAL ORIGIN OF LUNG CANCER IN GAS-GENERATOR WORKERS. Z. Krebsforsch., 45(1):36-39, 1936. Translated from German by Z. Knowles, National Institutes of Health, Bethesda, Md., Div. of Research Services, 5p., Feb. 15, 1969.

The origin and clinical aspects of lung cancer in gas-generator workers in steel plants were discussed. Twelve cases of lung cancer were found in three years in gas-workers. The average age of the patients was 42.5 years and the average length of occupation as a gas worker was 15.5 years. Early signs of lung cancer were an irritating cough, a feeling of anxiety, a pain in the side, cardialgia, headaches, bloody sputum, and facial edema. During the course of the illness, all patients complained of throat irritation. In the majority of cases, the tumor was found in the upper lr levels on the right side. Gas-generator workers are in close vicinity to the furnace and are forced to inhale the hot brownish gas and fine dust that usually contains large amount of tars known to contain carcinogens. The carcinogenic substances in tar were being explored.

7178 APTIC NUMBER 16095

Lader, M. H. and H. Morris
EFFECT OF NITROUS OXIDE ON THE AUDITORY EVOKED RESPONSE IN MAN. Nature, 218(5146):1081-1082, June 15, 1968. 6 refs.

The effect of nitrous oxide on the auditory evoked response in man was studied. Nitrous oxide was used in sub-anesthetic doses, 12.5% in oxygen, and 25% in oxygen and compared to the effects with that of pure oxygen in twelve normal volunteer subjects. The electroencephalogram was recorded from bipolar electrodes, one situated on the vertex, and the other over the frontal area. Standardized click stimuli of moderate intensity were applied every 2.0 sec through a loudspeaker situated 25 cm behind the subjects head. The evoked response was fairly consistent within each subject and there was some variation among the individuals. The results suggest that the effect of the drug was most marked on the negative wave and less marked on the two positive waves on each side. The early wave up to 38 millisec was probably not affected very much by the drug. The negative peak at 212 millisec latency was also unaffected. The later waves with such inter-individual variability also showed no consistent drug effects. The diminution in amplitude of the potentials could be a result of a decrease in the number of neuronal elements subserving associative functions which are activated by the stimulus. Alternatively, or in addition, these elements might be firing more asynchronously. It was clear that evoked potentials can provide a sensitive and reproducible index of the action of nitrous oxide in man. For the negative potential, 67% of the within-subject variability was attributed to a linearly-dose dependent drug effect. The technique can be employed in the assessment of a wide range of sedative drugs and perhaps of other psychotropic agents.

7179 APTIC NUMBER 16110

Lewis, H. E., A. W. Foster, B. J. Mullan, R. W. Cox, and R. P. Clark
AERODYNAMICS OF THE HUMAN MICROENVIRONMENT. Lancet, 1(7609):1273-1277, June 28, 1969. 16 refs.

The skin is separated from the ambient atmosphere by a layer of convecting air. This boundary layer was photographed using color schlieren cinephotography, a technique which makes use of the fact that this boundary air is warmer, less dense, and has a refractive index different from that of the ambient air. Starting at the feet, there is a layer of air which passes upward adjacent to the surface of the body, it thickness progressively increasing as it rises and accelerates. At times the outer part of the boundary layer becomes partly detached. When the layer passes over the face some of it enters the nose. The air flow reaches the orbit, pasres over the eye, and clears the cornea by about a millimeter. The maximum velocity of the boundary layer at head level is about 0.5 m per second. Preliminary experiments reveal that the human microenvironment has a significantly higher content of microorganisms than the ambient air. The source of bacteria is either the skin and/or the ambient air. Since some of the air of the microenvironment is inhaled during the respiratory cycle, this may be one of the missing links in the natural history of airborne infection; it may also provide a connection between skin disease and respiratory disease. Particles, pollens, and microorganisms in the air, entrained and concentrated by the boundary layer, could be presented to the nasal orifice and inhaled. There is inevitable dissemination to the ambient air of microorganisms by the human boundary layer, and this may be a mechanism in hospital sepsis. In special circumstances, such as transplant surgery, treatment of burns, leukemia, by isolating the surgeon or nurses in a pneumatic suit, it may be possible to reduce this serious complication. (Author summary modified)

7180 APTIC NUMBER 16356

Lichtenstein, E. P., K. R. Schulz, T. W. Fuhremann, and T. T. Liang
BIOLOGICAL INTERACTION BETWEEN PLASTICIZERS AND INSECTIDICES.
J. Econ. Entomol., 62(4):761-765, Aug. 1969. 10 refs.

The toxicity of polychlorinated bi- or triphenyl plasticizers, both singly and in combination with dieldrin or DDT, was investigated in tests on Drosophila melanogaster Meigen and house flies. Many of the more volatile plasticizers were toxic to both test insects, but to a lesser extent than dieldrin or DDT. As measured by the percent mortality of the insects over a 24- or 48-hr exposure period, dieldrin was the most toxic compound. Approximately 25 and 30 times more DDT and 8000 and 1000 times more plasticizers were required to obtain mortalities comparable to those achieved with dieldrin. The toxicity of the plasticizers increased with a decrease in their chlorine content. The more highly chlorinated and less volatile plasticizers were nontoxic, even when used at dosages of 2000 micrograms with D. melanogaster and 20 micrograms/ house fly. Though no appreciable insect mortalities were observed with plasticizers alone, they significantly increased to toxic effects of both dieldrin and DDT. While no conclusions can be drawn concerning the combined effects of plasticizers and insecticides in tissues of higher animals, the potential hazards of plasticizers, especially in combination with other synthetic chemicals, should not be disregarded.

7181 APTIC NUMBER 13625

Lindberg, Walter
AIR POLLUTION IN NORWAY. II. PUBLIC HEALTH ASPECTS OF AIR POLLUTION - A LITERATURE STUDY. (Den Almennelige Luftforurensning i Norge. Luftforurensning som Helseproblem, - en Litteraturstudie.) Translated from Norwegian. Oslo Univ. (Norway), p. 66-77, 1968.

This presentation discusses functional and anatomical changes arising from diseases caused by air pollution. The discussion includes air pollution episodes, pollutants known to cause specific effects (arsenic compounds, mercury, beryllium compounds, manganese compounds, and lead). Lead and carbon monoxide are discussed in greater detail. Emphasis is also placed on respiratory irritations caused by SO2, nonspecific upper respiratory diseases, the effect of air pollution on the occurrence of colds, smoking, chronic bronchitis emphysema, bronchial asthma, lung cancer, and heart disease.

7182 APTIC NUMBER 16231

Lucas, B. G. B. and Dorothy H. Strangeways
THE NATURE OF THE NERVE CELL CHANGES IN THE HIPPOCAMPUS FOLLOWING ANOXIA. J. Path. Bacteriol. (Londcn), vol. 86:283-291, Oct. 1963. 8 refs.

The results of 53 brains that showed damage in the hippocampus are presented. After exposure to anoxia induced in various ways, a proportion of guinea pigs showed cellular changes in the hippocampus that altered with time. The maximum histological damage was seen about the 4th day, after which some cells disappeared and were replaced by glial tissue, while others gradually resumed a more normal appearance. Comparison of these alterations with descriptions of well known standard classical changes showed that most of the latter are not separate entities, but different stages of one continuing change. Chronic cell change was seen during the early days and can be anoxic. If this is so, it may proceed to the ischemic change, which may lead on to the homogenizing change. It seems that if only the cytoplasm is acidophilic, it is possible for the cell to recover; if the nucleus also is acidophilic, destruction is likely. Finally, there is cell loss and gliosis. Pericellular spaces appear to be of two kinds. In the early days, small irregular spaces were seen, which may be due to anoxic or may be artefacts. The large spherical spaces that appeared later seemed to be swollen oligodendroglia and not to be due to an alteration in the nerve cell itself. (Author summary modified)

7183 APTIC NUMBER 16253

Luchi, Robert J. and Eve Marie Kritcher
DRUG EFFECTS ON CARDIAC MYOSIN ADENOSINE TRIPHOSPHASE ACTIVITY.
J. Pharmacol. Exp. Therap., 158(3):540-545, Dec. 1967. 13 refs.

Various agents known to alter cardiac contractility were examined for their effect on dog cardiac myosin adenosine

triphosphatase (ATPase) activity. Anesthetic agents were shown to have either the same, or no effect, on cardiac myosin ATPase activity which persisted through the extraction and purification phase. No stimulatory or depressant effect on enzyme activity was observed when quinidine, procaine amide, angiotensin, digitoxin, digoxin, ouabain or inotropic sympathomimetic amines were incubated with normal cardiac myosin. Myosin obtained from dogs with spontaneously occurring congestive heart failure also exhibited no change in enzyme activity in the presence of digoxin or the inotropic sympathomimetic amines. Calcium and magnesium ions, however, had an effect on cardiac myosin ATPase activity which correlated with their in vivo action on cardiac contractility. The effect of magnesium and calcium on myosin enzyme activity was studied further. The association constant between calcium and myosin is 18,000 with eight binding sites on the myosin molecule for calcium. Calcium activation of myosin ATPase activity appears to relate to the formation of calcium-ATP rather than to a direct effect of calcium on the myosin enzyme site. The inhibitory effect of magnesium on calcium-activated myosin ATPase activity could not be related to reduced calcium-ATP formation or to a direct effect of magnesium on the myosin molecule. (Author abstract modified)

7184 APTIC NUMBER 15987

McNamara, B. P. and W. H. Danker
ODOR AND TASTE. In: Basic Principles of Sensory Evaluation. American Society for Testing and Materials, Philadelphia, Pa., STP-433, p. 13-18, 1968. 12 refs.

Difficulties encountered in evaluating response to odor and taste are discussed. These senses are not as fully understood as hearing or seeing, nor are adequate physico-chemical instruments available for their evaluation. Those theories suggesting that there are absorption sites on olfactory hairs for different odors, and that temporal and spatial patterns of neural activity are responsible for the sensing of different odors, are now receiving serious consideration. It is thought that some enzymatic changes occur in the olfactory receptor during smelling. Electrically-recorded response to odors is rapid, but clean air should be breathed between evaluations. Moreover, odorous substances must be volatile enough to get into the air near the sensory area, and also partly soluble in the mucuous covering olfactory receptors. The four basic taste tests are sourness, sweetness, saltiness, and bitterness. There is a large variation among the tests in the concentration needed to activate taste receptors. Threshold concentrations for sugar are greater than for salt; greater for salt than for sour; and less of many bitter substances can be tested. In general, much higher concentrations are needed to detect tastes than to detect odors.

7185 APTIC NUMBER 16495

Mitrovic, Ljiljana, Lj. Simeonov, and H. Udzvarlic
AIR POLLUTION AND CHRONIC BRONCHITIS IN SARAJEVO. (Aerozagadenje i hronicni bronhitis u sarajevu). Text in Croatian. Med. Arhiv., 22(1-2):31-43, 1968. 14 refs.

The degree of air pollution and the prevalence of chronic bronchitis in Sarajevo was determined. Measurements of sulfur dioxide and fumes at three locations showed that there was a high degree of pollution in the center of the town. The peak concentration was in January and the lowest was in July. The prevalence of bronchitis was determined with questionnaires. Two groups of the population were included, the first being in the polluted part of town, and the second in the relatively clean part of town. Each person lived for 5 years in the area. The results for 663 males were tabulated according to the place of residence, age, and smoking habits. The rate of chronic bronchitis was 11-15% in the 25-34 age group, and 32% in the 45-54 age group. Smokers suffered chronic bronchitis more than non-smokers. There was no significant differences between prevalence rates in polluted and non-polluted areas. It was concluded that the prevalence rate is not an exact measure in determining the role of air pollution in causing chronic bronchitis. A long term investigation was recommended. (Author summary modified)

7186 APTIC NUMBER 16252

Munson, Edwin S., W. Reynolds Maier, and Donald Caton
EFFECTS OF HALOTHANE, CYCLOPROPANE AND NITROUS OXIDE ON ISOLATED HUMAN UTERINE MUSCLE. J. Obstet. Gynaecol. Brit. Commonwealth, 76(1):27-33, Jan. 1969. 14 refs.

The spontaneous contractility of isolated human non-gravid uterine muscle strips was studied during exposure to various concentrations of halothane, cyclopropane, and nitrous oxide. Mean contractility values for 10 per cent cyclopropane and 50 per cent nitrous oxide were not significantly different from control values. Halothane in 0.37 per cent concentration produced a significant reduction in contractility. Further reduction in contractility was proportional to the halothane concentration. It is predicted that inhibition of contractility would occur at a halothane concentration (partial pressure) of 1.2 per cent. At an equivalent anaesthetic concentration of cyclopropane (15 per cent) contractility was 57 per cent of the control value. The results showed no significant reduction in the resting tension of non-gravid muscle strips during exposure to halothane in concentrations capable of affecting marked reductions in contractility. It was concluded that at equivalent anaesthetic concentrations, halothane is a more potent depressant of non-gravid uterine muscle than nitrous oxide or cyclopropane. Of the agents studied, cyclopropane was the least depressant. (Author summary modified)

7187 APTIC NUMBER 16147

Nakazawa, Hirosuke
INFLUENCE OF SULFUR DIOXIDE (SO2) ON ASTHMATIC PATIENTS. (Aryusangasu (SO2) no kikanshi zensoku kanja ni taisuru eikyo oyobi sono sayokijo no kento). Text in Japanese. Nippon Naika Gakkai Zasshi (Tokyo), 58(8):719-730, Aug. 10, 1969. 20 refs.

Although it has long been conjectured that bronchial asthma patients are extremely sensitive to SO2, there have been few

medical studies on the subject. Except for some experimental studies on healthy men or cats under the influence of anesthesia, there are no reports on the effect of SO2 on the trachea. It is reasonable, however, to suppose that air pollution strongly influences bronchial asthma patients and that the effect of SO2 on these patients is not always identical with that on healthy men. The reaction of the respiratory system to inhaled SO2 was observed in 30 bronchial asthma patients and 11 healthy individuals. Much effort was centered on windpipe resistance. The asthmatic patients showed a stronger sensitivity, to even low SO2 concentration within a shorter time period, than the healthy subjects. In an attempt to solve the mechanism of the SO2 effect on the trachea 11 asthmatic patients were given sulfurous atropine. The pattern of the response of the windpipe to sulfurous atropine in asthmatic patients appeared to differ from that observed in healthy individuals.

7188 APTIC NUMBER 16148

Nishii, Syunzi
ON THE INFLUENCE OF EXHAUST GAS OF AUTOMOBILE ON HUMAN BODY. (Jidosha haikigasu ni yoru osenkuki no jintai ni oyobosu eikyo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):93-99, Feb. 15, 1966.

Auto exhaust gas contains various toxic compounds injurious to human health. In considering engine exhausts, it is worthwhile to recognize the percentage of exhaust gas emission per 1 per min represented by such toxic compounds as CO, CO2, ethane (C1-C3), and butane (C4) during engine idling at acceleration to 30 km/h, regular speed at 50 km/h, and deceleration from 30 km/h. However, it is difficult to investigate the influence of engine exhausts on the human body because the toxicity of its components of dependents on geographical and weather conditions and ventilation factors. Few studies and surveys bearing on the subject are available. In the present study, a field survey was conducted of traffic policemen, policemen on motorcycle patrol, and inhabitants of residences bordering on streets. Traffic policemen are sometimes exposed to 100 ppm CO, and they report headaches, thirst, drowsiness, memory failures, and eye troubles. The fact that policemen on motorcycles have a much higher percentage of physical complaints supports the assumption that these troubles are attributable to the effect of auto exhaust gas: the policeman on a motorcycle is exposed to the worst conditions of engine exhaust. It is significant that persons residing on or near streets have a higher proportion of physical complaints than those living 100 m away from streets.

7189 APTIC NUMBER 16705

Pace, Donald M., Paul A. Landolt, and Byron T. Aftonomos
EFFECTS OF OZONE ON CELLS IN VITRO. Arch. Environ. Health, 18(2):165-170, Feb. 1969. 16 refs.

Even low concentrations of O3 (4 ppm) appear to retard cell proliferation and interfere with mitotic activity. The effect of O3 seems to depend not only upon concentration of the gas and length of exposure, but also upon cell density: The greater the numbers, the greater the resistance. It is probable that O3 may damage the cell membrane, as is shown by the increased vacuolar content and consequent "swelling" of the cells. Furthermore, it alters the collagenous-like substance by means of which cells attach themselves to the substratum so that they tend to become detached. Results also suggest that cells in vitro may develop a tolerance to O3. No explanation can be given at present but the possibility suggested by Stokinger, the stimulation of activity of the pentose phosphate pathway, could apply. (Author's Abstract)

7190 APTIC NUMBER 16604

Parbrook, Geoffrey D.
LEUCOPENIC EFFECTS OF PROLONGED NITROUS OXIDE TREATMENT. Brit. J. Anaesthesia, vol. 39:119-127, May 1967. 34 refs.

The leukopenic effects of nitrous oxide were studied in rodents, with and without surgical wounds. The animals were exposed to air, 25% nitrous oxide, 60% nitrous oxide (rats only), and 40% nitrous oxide (mice only). The oxygen percentage was maintained at 21% in the four cases. Leukopenic effects and suppression of the normal leukocytosis to trauma was observed with all concentrations of nitrous oxide after 2 days of treatment. The effect of 60% nitrous oxide was greater than 25% nitrous oxide after 7 days, but the difference was less pronounced in the first 4 days. The leukopenic effect was also greater in animals with surgical wounds. Granulopenia was present after 3 days, but not after 1 day of nitrous oxide exposure, and persisted for at least 3 days after the completion of treatment. Possible mechanisms of nitrous oxide toxicity were discussed. It was supposed that the presence of higher nitrogen oxides in nitrous oxide is of considerable importance. There is also the possibility of traces of nitrous oxide being metabolized to chemically more active oxides in the marrow cells. An alternative theory of the mechanism of nitrous oxide toxicity is that there may be a link between drugs producing anesthesia and effects of mitosis and leukocytes. It was concluded that it is doubtful whether continuous nitrous oxide therapy can be recommended for routine postoperative sedation for periods of over 48 hrs. There appears to be a risk that the nitrous oxide may inhibit a leukocytosis, in response to trauma and infection, and may lower patients' resistance.

7191 APTIC NUMBER 16598

Pekker, I. L.
EFFECT OF NITROUS OXIDE ON THE EXPERIMENTALLY INDUCED SPASM OF THE CORONARY VESSELS OF THE HEART. (Vliyaniye zakisi azota na eksperimental'no vyzvan nyy spazm venechnykh sosudov serdtsa). Text in Russian. Kardiologiya (Moscow), vol 6:74-78, July-Aug. 1966. 2 refs.

Anesthetization with nitrous oxide in cases of sthenocardia and of myocardial infarction has found a wide application in the practice of emergency medical treatments and in a series of clinics. Observations made at the Leningrad station of emergency medical treatment have shown that in many patients suffering from sthenocardia and from myocardial infarcion, after

anesthetization with nitrous oxide, there appeared on the electrocardiogram symptoms of an improvement of the coronary blood circulation, along with the disappearance of the pain. These observations suggest that nitrous oxide, in possessing analgesic properties, has the ability to expand the spastic coronary arteries. The effect of nitrous oxide was studied in a mixture with oxygen on the 'peripheral' and the 'central' spasm of the coronary arteries. Tests were made on cats anesthetized with urethane. Before the spasm of coronary arteries induced by intravenous injection of pituitrine as well as during its initiation, electrocardiograms were made as a control experiment. After 5 to 6 hours, 5 minutes after inhalation of nitrous oxide in a mixture with oxygen, pituitrine was again introduced into the same cat in the same dosage. The new electrocardiogram was compared with the control one. After removal of the cerebellum, stimulations of various morphological structures of the medulla oblongata were produced with a unipolar electrode by square pulses lasting 5 to 10 sec with an interval of 8 to 10 min. Electrocardiograms were made before, during, and after cessation of the stimulation. After appearance on the electrocardiogram of symptoms of a spasm of coronary arteries, which served as a control, the experiment was repeated during inhalation of nitrous oxide (5 minutes after beginning the inhalation). At the end of the experiments, the position of the electrode was checked by means of electrolytic destruction of the region of irritation with a subsequent histological treatment of the sample. Nitrous oxide in mixtures with oxygen, 1:1, 1.5:1, 2:1, and 2.5:1, prevented the origination of the central spasm of coronary arteries, induced by stimulation of various morphological structures of the reticular formation of the brain. The effectiveness of nitrous oxide depended on its concentration in the mixture, on the type of disturbance of the rhythm of the cardiac activity, on the concomitant coronary deficiency, and on the morphological structure, subjected to stimulation. Nitrous oxide did not prevent the origination of the 'peripheral' spasm of coronary arteries, induced by the introduction of piluitrine.

7192 APTIC NUMBER 16460

Podgornova, N. S.
HEALTH PROBLEMS IN THE INSTRUCTION OF STUDENTS IN A CHEMICAL TECHNICAL SCHOOL. (Gigienicheskie voprosy obucheniya studentov khimicheskogo tekhnikuma). Text in Russian. Gigiena i Sanit., no. 9:112-114, 1966.

Psychological and physical studies were made of 85 students aged 15-18 years enrolled in three courses of study at the Moscow Chemical-Technological school during one semester. In Course I, students had 5 weeks of classroom work, 4 weeks of shop work, and then returned to classrooms for the remainder of the semester. Students in Course II had 6 hours of laboratory work one day a week in addition to daily classroom work. Students in Course III had classroom instruction all semester. At the end of the semester, all groups showed a decrease in work capability and physiological changes which were more marked in students in Courses I and II. No decrease in function was noted at the end of the day in students having shop or laboratory work. More control by the instructor is recommended in order to decrease fumes of nitric acid in laboratories.

7193 APTIC NUMBER 16371

Poetzl, Karl and Reinhold Reiter
STUDY OF THE RETENTION OF CHEMICAL COMPONENTS OF INDUSTRIAL AEROSOLS. (Zur Retinierbarkeit der chemischen Komponenten von Industrieaerosolen). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 19(9):1-8, 1969. 6 refs.

Studies of aerosol retention were conducted in the vicinity of a converter of a metallurgical plant, a fire-clay retort, and a kaolin production plant using a respiratory tract model, which simulates retention of particles of unknown aerosol mixtures in the trachea, the bronchi and the alveoli. It also simulates exhalation. Apart from the total amount of aerosols retained in the respiratory tract sections, the distribution of the most important chemical aerosol components across the respiratory tract was determined. Retention of the various chemical components of aerosols in the sections of the respiratory tract differed quite markedly. The low retention of ferric oxide was striking; it was almost never found in the alveoli. Quite contrary to that, aluminum oxide was retained in high quantities, primarily in the alveoli and the bronchi, and rarely in the trachea. Silicon dioxide was mainly retained in the trachea. As far as the total aerosol retention was concerned, it increased with decreasing distance from the source. No marked differences of retention of the two main components ($SiO_2$ and $Al_2O_3$) of the aerosol from the fire-clay retort were observed. The total retention of the latter aerosol was, however, much higher than that of the converter aerosol. Total retention of the aerosol mixture of the kaolin manufacturing plant was remarkably high (90 and 95%) primarily in the upper respiratory tract and the bronchi.

7194 APTIC NUMBER 16613

Prys-Roberts, C.
PRINCIPLES OF TREATMENT OF POISONING BY HIGHER OXIDES OF NITROGEN. Brit. J. Anaesthesia, vol. 39:432-439, May 1967. 39 refs.

The main methods of treatment for patients exposed to the noxious effects of nitric oxide, nitrogen dioxide, or the fumes of nitric acid are outlined. High concentrations of nitrogen oxides cause reflex inhibition of breathing with laryngospasm. Intense cyanosis develops rapidly. Therefore, severe hypoxia may occur. There is a tendency for the ventilatory frequency to increase, and pulmonary edema may occur in the acute phase. Oxygen therapy is recommended which consists of administering 100% oxygen, either by spontaneous or artificial ventilation in order to compensate for the decreased oxygen capacity and content of the arterial blood. Reconversion of methemoglobin by the use of methylene blue (2mg/kg) initially is advocated, with subsequent dosage titrated against the methemoglobin concentration in the blood. Prevention and treatment of chemical pneumonitis combines endobronchial and parenteral administration of corticosteroid preparations, together with bronchial lavage and suction. The metabolic component of acid-base derangement is corrected by intravenously administering sodium bicarbonate. Artificial ventilation by intermittent positive pressure ventilation may

be indicated in patients who demonstrate ventilatory failure manifested by a rising arterial carbon dioxide pressure. Circulatory therapy is accomplished by the use of vasopressor agents to combat severe systeaic hypotension. Associated drug therapy using dimercaprol is advocated in severe cases in view of the protective action of this type of agent against the higher nitrogen oxides. Bronchodilators may be indicated in order to alleviate bronchospasm arising from the irritant effects of the inhaled gases. (Author conclusions modified)

7195 APTIC NUMBER 16246

Reiter, R.
ELIMINATION OF ELECTRIC CHARGES IN THREE SECTIONS OF THE HUMAN RESPIRATORY TRACT WHEN INHALING VARIOUS INDUSTRIAL AEROSOLS. (Studie ueber die Abscheidung elektrischer Ladungen in drei Abschnitten des menschlichen Atemtraktes bei Einatmung unterschiedlicher Industrieaerosole). Text in German. Zentr. Aerosol-Forsch. V (Stuttgart), 13(7):3-19, Nov. 1967. 43 refs.

The electric charge of inhaled aerosol particles may influence the precipitation process in the respiratory tract and may have a biological effect. It is known that negative charges, if precipitated in sufficient amounts, accelerate the ciliary movement; positive charges hamper the movement and cause muscle cramps in the trachea. The distribution of electric aerosol charges in the respiratory tract was determined with a respiratory tract model. The model simulates retention of thee particles contained in a polydisperse aerosol in three sections of the respiratory tract: the trachea, the bronchi, and the alveoli; it also indicates the amount of dust exhaled again. The measurements were taken in the smoke plumes of various industrial plants (cement factory, kaolin plant, sintering plant, converter). It was found that the charges found in the various stages and the ratios to each other differed greatly and depended on the type of aerosol source. A grouping according to charge polarity was observed in the respiratory tract, even in the case when the aerosol cloud appeared to be neutral. The electrical surface charge in the respiratory tract was in some cases far above the threshold of biological effects as known from the literature.

7196 APTIC NUMBER 13509

Robertson, P. C., N. H. Anthonisen, and D. Ross
EFFECT OF INSPIRATORY FLOW RATE ON REGIONAL DISTRIBUTION OF INSPIRED GAS. J. Appl. Physicl., 26(4):438-443, April 1969. 10 refs.

The study was conducted to determine the effect of inspiratory flow rate in the pattern of regional distribution of inspired gas. Measured boli of Xe133 in 4 ml of air were inspired at varying flow rates from residual volume (RV) or higher lung volumes in seven erect men. Concentration of Xe133 was measured at total lung capacity in five regions of each lung, from base to apex, by chest scintillation counters. Mouth concentration of the labeled compound was also measured during the subsequent 15-sec expiration to RV. It was found that the boli inhaled at RV were distributed preferentially to apical regions by inspiratory flow rates of 0.2 to 0.3 liter per sec. and that faster inspiratory rates of 3 to 5 liter per sec. produced a more uniform regional distribution pattern. The apex-to-base concentration gradients were 10:1 and 2:1 following slow and rapid inspirations respectively. A conspicuous flattening of the expiratory Xe133 alveolar plateau was produced with fast inspiration as compared to that of slow inspiration. These results are compatible with airway closure of the lower lung regions at RV and with the opening of these airways at lower lung volumes in rapid inspiration resulting from the increased transpulmonary pressures associated with fast inspiration. Boli inhaled above 40 percent of vital capacity were distributed preferentially to the basal regions; but rapid inspiration produced a slightly more even distribution than slow inspiration, which implies a sequential distribution of ventilation was potentially present at these lung volumes.

7197 APTIC NUMBER 16600

Sapegin, D. I.
EFFECTS OF CARDIAC GLYCOSIDES ON THE OXYGEN INTAKE AND ITS TENSION IN CEREBRAL AND MUSCLE TISSUES. (Vliyaniye serdechykh glikozidov na postupleniye kisloroda i napryazheniye yego v mozgovoy i myshechnoy tkanyakh). Text in Russian. Farmakol. i Toksikol. (Moscow), 30(3):308-312, May-June 1967. 19 refs.

The effects were studied of solutions of strophanthin (0.05%), convallatoxin (0.03%), erysimine (0.03%), periplocin (0.025%) and cymarine (0.05%), (introduced intravenously during 4 to 6 min in doses of 0.04 ml/kg) on the oxygen intake by the tissues and its tension in the brain and the striated muscles of dogs with hypoxia, induced by intraperitoneal introduction of 40 to 60 mg/kg of nembutal or by intoxication with nitrogen oxides. Nembutal produces a deep narcosis with severe impairment of breathing and cardiac activity; the nitrogen oxides produce toxic emphysema. In the tests, the intake of oxygen by the head tissues was calculated from the arterio-venous difference of oxyhemoglobin and the volume rate of flow of the blood stream in the outer jugular vein. The oxyhemoglobin concentrations in the carotid and the outer jugular vein were recorded by oxyhemographs 036-M by the method of Kisin, while the volume rate of flow of the blood stream in the outer jugular vein was recorded by the pump-flowmeter of Kisin and Tsaturov. The oxygen tensions in the cortex and the subcortex of the temporal section of the brain, and in the muscles of the tongue were determined polarographically using Epstein electrodes. The depolarization current was recorded by the oxyhemograph. The external breathing was recorded by a pneumograph; the pressure in the carotid, by a mercury manometer. Strophanthene, convallatoxin, erysimine, periplocin and cymarine introduced, in the pressure of hypoxia, increase the oxygen absorption by the tissues of the head and the oxygen tension in the skeletal muscles. The oxygen tension in the brain is increased to a lesser degree than in the muscles and actually decreased by them. The most pronounced changes were found to be caused by strophanthene and convallatoxin; somewhat less obvious ones were observed by erysimine, and quite insignificant ones, by periplocin. The effect of cymarine was erratic.

7198 APTIC NUMBER 16542

Saruta, Hamio, Noburu Ishinishi, Yasushi Kodama, and Eizaburo Kunitake
EFFECTS OF GASEOUS POLLUTANTS ON HUMAN HEALTH. (Yugai gasu ni yoru taiki osen no jintai ni oyobosu eikyo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(7):445-450, Aug. 15, 1966. 12 refs.

In London, the average daily death rate has increased 1.3- to 2.6-fold on days of dense smogs. For instance, the death rate during the smog episode of 1952 was 2.6 times higher than average. About 6000 persons, mostly over 40, who had chronic respiratory difficulties were affected by the smog. The symptoms they exhibited were severe cough, throat pain, labored respiration, harsh voice, fever, headache, and vomiting. The death rate due to air pollution in London or other northern European countries is of particular interest because heavy smoggy days are frequently characterized by the absence of wind. This has not been the case in Japan. A comparative medical survey of industrial and rural areas showed a higher incidence of respiratory organ disease and lung cancer than in industrial areas. Though suggesting that lung cancer has a close relationship with air pollution, the finding should be reconfirmed in connection with cigarette smoking, since 3,4-benzpyrene, supposedly responsible for causing lung cancer, is contained in both smoke dust and cigarette smoke.

7199 APTIC NUMBER 14455

Saruta, Hamio, Shin Ishinishi, Tai Kodama, and Eizaburo Kunitake
RESPIRATORY DISEASES AND AIR POLLUTION. (Kokyu Shikkan to Taikiosen.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6(1):18-23, April 1968.

All the medical records kept in every hospital in the following five districts for the past six years were inspected and analyzed statistically with respect to the incidence of respiratory diseases: District A- industrial area; District B and C- center city; and Districts D and E- suburban area. The following are tentative results: 1. The rate of occurrence of rhinitis in district A was twice as high as those in districts B,C,D, and E. 2. Incidence of bronchitis in district A was higher than those in districts B and E, but almost the same as those in districts C and D. District D is not suitable as a control, since the manufacture of furniture which utilizes organic solvents has been developing recently in that area. 3. The rate of occurrence of asthma in district A was higher than those in districts B, D, and E. However, district C showed a higher rate of incidence than district A. This is due to the fact that there are many large hospitals in district C, to which many complicated cases are transferred. District C, therefore, is also an inadequate control. 4. The A district showed a higher incidence of tuberculosis than districts B,D, and E; but again, it showed a lower rate than district C. 5. Since the total number of emphysematous patients was small, no conclusion was obtained for this disease. 6. Incidence of pulmonary cancer was higher in the A district than in districts B, D, and E, but lower than in district C. 7. Incidence of cancer of the nose and pharynx was highest in district A.

7200 APTIC NUMBER 16219

Schlipkoeter, H. W.
DANGERS OF THE METROPOLITAN CITY AIR. (Gefahren der Grossstadtluft). Text in German. Oeffentl. Gesundheitswesen (Stuttgart), 29(3):117-126, March 1967. 37 refs.

Differentiation between the amount of fine dust and coarse dust makes it feasible to obtain information on possible health perils, since it is known that primarily the fine dust penetrates into the human body, while the coarse dust deposits on buildings and objects. The dust concentration fluctuates with the wind conditions; it varies with the seasons and over the course of a week. The fine dust shows a maximum at the beginning of the week; the coarse dust, in the middle of the week. It is much more difficult to assess objectively the harms of odors. Test persons have to render their subjective opinion on the intensity of odors. In order to determine the effect of gases, dusts, and liquid aerosols on humans, the physical disposition and age must be taken into consideration. Several tests were conducted to get an estimate of the amount of benzopyrene retained by a human during his lifetime. It was found that only a maximum of 0.06 microgram of benzo(3-4)pyrene (BP) was retained by the lungs. To test how fast the benzopyrene content is dissolved, white rats received 20 mg of soot containing 12 microgram BP/g dust. In the first three days, 80% of the BP content separated from the soot while 20% remained adsorbed on the soot for more than 20 days. Tests also showed that sudden high air pollution concentrations (at temperature inversions) speeded the death of humans. The increase of the mortality rate of such conditions but no higher mortality over a longer period of time (e.g., 2 years) leads to this assumption.

7201 APTIC NUMBER 15943

Selikoff, I. J.
ASBESTOS. Environment, 11(2):3-7, March 1969. 15 refs.
(Presented at the Symp. on Unanticipated Environmental Hazards Resulting from Technolcgical Intrustions, Am. Assoc. Advancement of Sci. Committee on Sci. in the Promotion of Human Welfare and the Scientists' Inst. for Public Inform., Dallas, Texas, Dec. 28, 1968.)

The magnitude of the hazard associated with direct occupational exposure to asbestos was confirmed by a 19-year study (1943 to 1963) of 632 insulation workers exposed to asbestos for 20 years or more. The expected number of deaths among the workers was 203. The actual number was 255. Forth-five deaths were due to cancer of the lungs or pleura; 29, to cancer of the stomach or colon; and 12, to asbestosis. Similar mortality statistics were obtained for 370 workers observed from 1963 to 1967. Where 47 deaths were expected, 49 occurred. Again, there was a significant excess of cancer. Studies in South Africa and Finland are also reported. They indicate that utilization of asbestos poses an indirect environmental hazard. Of 47 cases of mesothelioma in

Cape Province, 45 lived in areas where asbestos was mined or worked in an environment where indirect, haphazard exposure was conceivable. In an asbestos mining county of Finland, 499 out of 6312 individuals X-rayed had pleural calcification. No calcification was found among 7100 individuals in the adjoining county. In Capetown, asbestos bodies were found in 26% of 500 successive autopsies of nonasbestos workers.

7202 APTIC NUMBER 16606

Shiel, F. O'M.
MORBID ANATOMICAL CHANGES IN THE LUNGS OF DOGS AFTER INHALATION OF HIGHER OXIDES OF NITROGEN DURING ANAESTHESIA. Brit. J. Anaesthesia, vol. 39:413-424, May 1967. 13 refs.

Twelve dogs were anesthetized with pentobarbitone and exposed to nitric oxide and nitrogen dioxide. Three dogs recovered. One dog was sacrificed after 24 hours and the other two were sacrificed after 48 hours. Autopsy was performed and the pathological changes of the lungs were described in detail. Changes in the lungs included edema, focal collapse and hyperinflation, diffuse and focal intravascular congestion, desquamation of bronchiolar mucosa, intra-alveolar hemorrhage, focal inflammatory and mucosal cell plugging of bronchioles, hyperplasia and regeneration of terminal bronchiolar mucosa, cellularity and necrosis of alveolar walls, intra-alveolar and peribronchial histiocytes, and focal and bronchopneumonia. Generally, the severity of the lesions was a function of the duration and concentration of the gaseous exposure. The most severe effects were seen in two of the surviving dogs. The acutely lethal exposure appeared to lie between 22 and 35 minutes at a concentration of 0.5% nitrogen oxide. While metabolic alterations are of primary relevance to the deaths of the non-surviving dogs, the pathological features were apparently the acute results from highly irritant gases. The areas of alveolar hyperinflation tended to occur adjacent to these lesions and were attributed to an acute compensatory effect. In the surviving dogs, the florid inflammatory cellular response was an expected progression and there was no sign of secondary bacterial infection at the stage of examination. The possibility of local increase in irritant concentration was postulated on the basis that the nitrogen oxides form solutions of nitrous and nitric acids in quantity and concentration in those acini which first begin to flood with transudate. In addition, decreased or absent ventilation in the flooded alveoli will lead to capillary endothelial anoxic necrosis resulting in focal hemorrhage.

7203 APTIC NUMBER 12275

Slavgorodskiy, L. P.
BIOLOGICAL EFFECTS AND HYGIENIC EVALUATION OF AIR BY PHTHALIC ANHYDRIDE. In: The Biological Effects and Hygienic Importance of Atmospheric Pollutants, Book. Translated from Russian by B. S. Levine, U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 17, pp. 54-59, 1968.
CFSTI: PB 180522?

Exposure of humans and laboratory rats to atmospheric phthalic anhydride provided the following data: the threshold of phthalic anhydride (PhA) odor perception is 0.32 mg/cu m for most sensitive persons; 0.22 mg/cu m is the subthreshold concentration; analysis of the eye dark-adaptation curve for short-time inhalation of PhA indicated that its activity threshold is 0.92 mg/cu m, while 0.55 is a subthreshold concentration; 0.2 mg/cu m is recommended as the maximum single-exposure concentration of PhA; chronic, 24 hr., 70-day exposure to inhalation of vapors and aerosols of a PhA in concentrations of 1.32 and 0.54 mg/cu m elicted statistically reliable changes in the flexor and extensor chronaxy ratio in whole blood choline-sterase activity and in the thrombocyte count. A 0.2 mg/cu m PhA concentration proved inactive and is recommended as the average daily maximal concentration; for reasons discussed in a preceding paragraph of this paper, provision should be made for 1000 m sanitary break zones around plants built for the production of 10,000 tons of PhA per annum. (Author's conclusion, modified)##

7204 APTIC NUMBER 16520

Speizer, Frank E. and Gary L. Huber
SOME PHYSIOLOGIC, BIOCHEMICAL AND CELLULAR RESPONSES OF THE LUNG TO AIR POLLUTANTS. Milbank Mem. Fund Quart., 47(5):256:268, July 1969. 28 refs.

Applied physiologic experiments in the laboratory animal and man can demonstrate the acute effects of pollutants; but they are difficult to relate to the development of chronic human respiratory disease secondary to environmental air pollution. Therefore, more fundamental approaches to the pathophysiologic mechanisms of the production of respiratory disease must be sought. The two air pollutants that have been studied at concentrations comparable to those found in the ambient air are ozone and nitrogen dioxide. These pollutants appear to injure the pulmonary parenchyma directly and to impair the mechanisms by which the lung inactivates and destroys inspired bacteria. The complex role of diminished clearance and recurrent infection in the role of chronic respiratory disease and the pulmonary pathology in man associated with high levels of exposure must involve some breakdown in the host defense mechanism. The alveolar macrophage has been implicated as the key factor in the maintenance of the integrity of the host defense mechanism. In experimental animals, significant structural changes in the pulmonary alveolar macrophage have followed exposure to one ppm ozone; these alterations appear to correlate well with alterations in functions. It is hoped that studies of low levels of pollutants, combined with a multidisciplinary approach to basic biological phenomena, will yield some insights into the development of chronic respiratory disease.

7205 APTIC NUMBER 16552

Sugiyama, Takamoto and Masaru Igarashi
EFFECT OF AIR POLLUTION ON HUMAN HEALTH -- VIEWED FROM THE RESULT OF MEDICAL SURVEY IN OSAKA AND YOKKAICHI CITIES. (Taiki osen no jintai ni oyobosu eikyo ni tsuite -- Osaka Yokkaichi shi ni okeru

baiento eikyc chosa no kekka kara). Text in Japanese. Kogai to Taisaku, (J. Pollution Control), 2(3):169-173, March 1966.

Yokkaichi is a city where a large number of petroleum refineries are concentrated and atmospheric sulfur dioxide pollution is notorious. Each resident over 40 years of age was given a questionnaire patterned after that designed by the British Medical Research Council. Dust fall measurements conducted at the same time indicated the following results. Dust fall collected by deposit gauges was 16 to 18 ton/sq km/month in the most polluted area; the average was 6 to 12 ton/sq km/month. Atmospheric particles measured from 260.8 to 399.2 micrograms/cu m. The particles were analyzed for SO4, NO3, Ti, V, and other organic compounds, with the pararosaniline test employed to measure sulfur oxides. The maximum concentration was 0.37 ppm and the average, 0.10 ppm. The return rate of the questionnaire was about 80%. Items covered by the questionnaire included subjective symptoms of respiratory disease such as cough, phlegm, attacks of bronchial asthma, and shortness of breath, plus the duration of the symptoms. Residents in polluted areas reported more symptoms than those in nonpolluted areas. A similar tendency was found in the case of obstructive respiratory disease. Residents in the polluted area were more liable to chronic bronchitis than those in the nonpolluted area. It is concluded that respiratory disease is a closely related to air pollution, or at least that air pollution exerts an unfavorable effect on human health. Quantitative and qualitative measurements of the effects of pollutants will be reported at a later date.

7206 APTIC NUMBER 16532

Sugiyama, Takamoto
EFFECTS OF EXHAUSTED GAS FROM AUTOMOBILE ON HUMAN HEALTH. (Jintai eno eikyo kara toraeta jidosha haikigasu ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(5): 313-319, May 15, 1966.

In a study of auto exhaust gas, it is important that each toxic component be investigated individually and in combination. At a Detroit research institution, exhaust gas from a street is piped directly to a building, where its effects on mouse, guinea pig, and rabbit are observed. This is a practical approach to obtaining data and studying the direct effect of auto exhaust gas under actual conditions. There are no similar institutions in Japan, where research efforts are directed toward the study of individual toxic components. In this paper, discussion is focused on the effect of carbon monoxide on blood, i.e., on its strong chemical affinity with hemoglobin. Carbon monoxide affinity is said to be as much as 250-fold that of oxygen. The allowable concentration is, according to the industrial hygienics, 100 ppm, which is considered to produce about 15% of carboxyhemoglobin after several hours' exposure. The effects of CO on eyes and nerves are also considered. Very few studies of the effect of CO on human health have been made in Japan, and those available are limited to policemen or taxi-drivers. Atmospheric concentrations of CO exceeding 10 ppm increase carboxyhemoglobin in blood vessels more than 5%.

7207 APTIC NUMBER 16547

Teyssier, L. and R. Lesobre
THE PLEURAL PLAQUES OF NONPROFESSIONAL ASBESTOSIS. (Les plaques pleurales de l'asbestose non professionnelle). Text in French. J. Franc. Med. Chir. Thorac. (Paris), 22(7):797-808, 1968. 15 refs.

Clinical descriptions of two cases of non-occupational asbestosis are presented which are attributed to pollution of the atmosphere in the neighborhood of asbestos processing plants. The presence of so-called pleural plaques, which are readily identified on the ordinary X-ray pictures when they are calcified, should suggest asbestosis whenever none of the conventionally accepted causes of this disease can be discovered. An investigation designed to establish whether or not a patient suffering from these plaques was in fact exposed to asbestos dust in the past should include not only his occupational history, but also his non-occupational environment. In some cases, occupational and non-occupational exposures to asbestos dust have taken place in succession. In addition to the two cases described in detail, the tracing of the history of a patient who was never occupationally exposed to the danger of pneumoconiosis, but who had lived in his childhood in close proximity of an asbestos processing plant is given. As no instances of non-occupational asbestosis have been described in France, it was thought useful to point out that it should be taken into consideration in diagnosing certain pleural calcifications.

7208 APTIC NUMBER 15812

Thomas, Heriberto V., Peter K. Mueller, and Robert Wright
RESPONSE OF RAT LUNG MAST CELLS TO NITROGEN DIOXIDE INHALATION. J. Air Pollution Control Assoc., 17(1):33-35, Jan. 1967. 16 refs.

The hypothesis that irritant gases in concentrations occurring in polluted atmospheres might play a role in the degranulation and histamine release processes of mast cells in lung tissue was tested. Young rats weighing 140-150 g were exposed to 1 ppm nitrogen dioxide for 2 hr. One group was killed immediately, another group 24-27 hr after exposure. A third group was exposed to 0.5 ppm nitrogen dioxide for 4 hr and killed immediately. Animals serving as controls were placed for 1 hr into the exposure chamber ventilated with ambient air. Standard histological preparations were made after Carnoy's fixative and subsequent staining with toluidine blue. The mast cells of the control animals appeared relatively intact with no evidence of disorientation. The cells of the animals exposed to NO2 and sacrificed immediately revealed rupture and loss of cytoplasmic granules with some disorientation. These changes were observed in the pleura, bronchi, and surrounding tissue with the effects more marked in the mediastinum. In some cases, the mast cells of exposed animals sacrificed about 24-27 hr after discontinuing the exposure showed a combination of ruptured and intact cells with a predominance of the latter: in other cases, the cells could not be differentiated from those of the controls. The findings indicated that 24 hr or more are required to reverse the acute effects of NO2 inhalation. The toxicological implications are discussed: Loss of cell integrity caused by nitrogen dioxide is followed by the release of the proteolytic enzyme

chymotrypsin, the hydrolytic enzyme phospholipase A, and other substances. In acute reactions, the released granules are ingested by fiberblasts with the formation of new cells. In chronic situations, the formation of new cells gives way to fibrillo enesis and, ultimately, fibrotic tissue.
(Author abstract modified)

7209 APTIC NUMBER 16538

Tokyo Inst. of Technology (Japan), Kiyoura Lab.
ABATEMENT OF AIR POLLUTION, I - (2) SULPHUR DIOXIDE. (Aryusan haigasu ni yoru kogai bojo ho (sono II)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(2):41-43, June 15, 1965.

The most notorious incidents of sulfur dioxide pollution were the Meuse Valley, Donora, and London smog episodes. The Meuse Valley episode of December 1930 was caused primarily by exhaust gases emitted by refineries under a windless condition. Sixty-three persons died and several hundred were affected. The Donora incident of September 1948 also occurred under windless conditions. Twenty persons died and several thousand were affected. In December 1952, thick smog floated over London for five days. The maximum sulfur dioxide concentration reached 0.8 ppm. Four thousand persons died from respiratory trouble. One method of sulfur dioxide abatement is the Reinluft process. In a medium-scale test conducted by the Reinluft group, activated charcoal or semi-coke was circulated through an absorption and regeneration tower. Exhaust gas was led to the absorption tower after being cooled at 100 C. Desulfurized exhaust gas was emitted from the upper part of the tower. The activated charcoal with the adsorbed sulfur dioxide flowed into the regeneration tower. The hot carbon dioxide gas or nitrogen gas containing no oxygen gas was led into the tower. When the temperature reached 400 C, the sulfur dioxide was separated. Semi-coke was able to absorb sulfur dioxide at 10% of its own weight, i.e., one ton of semi-coke was needed to absorb 100 kg sulfur dioxide. The loss of activated charcoal was 350 kg per ton sulfur dioxide, of which the loss by combustion was 100 kg and the loss by rubbing 250 kg. The Department of Scientific and Industrial Research in England has established a pilot plant for the Reinluft process, which treats about 500 N cu m per hour exhaust gas.

7210 APTIC NUMBER 16521

Tokyo Metropolitan Government, Japan, Public Nuisance Control Div.
THE EMISSION SOURCES OF HCl AND NH3 AND THEIR STANDARD CONTROL EQUIPMENTS. (Enka suiso oyobi ammonia no hasseigen to sono hyojun jogai shisetsu ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(7):461-466, Aug. 15, 1966.

Hydrogen chloride is emitted by plants which produce pigments, dyes, industrial chemicals, medical supplies, and treat metal surfaces. Ten to 50 ppm HCl does not prohibit work, but is harmful to the teeth, nose, mucosa of the mouth, and face after long exposure. No one can work in air containing 50-100 ppm HCl. Ammonia is emitted by plants which produce pigments, manures, and medical supplies. Odor is noticed when the concentration reaches 100 ppm NH3. Chronic exposure to 400 ppm NH3 is harmful to the mucosa. Exposure to concentrations of 2500-6500 ppm NH3 for 30 minutes is dangerous, and exposure to concentrations of 5000-10,000 ppm NH3 quickly causes death. Hydrogen chloride and NH3 can be removed by absorption, adsorption, chemical reactions, and oxidation. Hydrogen chloride and NH3 dissolve easily in water which provides another suitable method for control. The water washing method is divided into a packed column, spray column, venturi scrubber and jet scrubber. The washing equipment consists of an air blower, a cleaning column, a pump, a water tank, and an exhaust pipe. The parts which come into contact with the gas must be constructed of an acid-alkali proof material. A mist catcher must be installed on top of the packed column. The hood must be carefully designed so the excess air is not inhaled. (Author abstract modified)

7211 APTIC NUMBER 16066

Toothill, C.
THE CHEMISTRY OF THE IN VIVO REACTION BETWEEN HEMOGLOBIN AND VARIOUS OXIDES OF NITROGEN. Brit. J. Anaesthesia, vol. 39:405-412, May 1967. 29 refs.

Nitric oxide reacts with hemoglobin in the same way as oxygen and carbon monoxide to form a ligand to the iron atom. The methemoglobin formation during the administration of nitric oxide and nitrogen dioxide in the concentration range 0.1-2% to anesthetized dogs was investigated. Massive conversion of oxyhemoglobin to methemoglobin was found in a series of anesthetized dogs exposed to 2% nitric oxide or nitrogen dioxide. One hundred percent conversion occurred in one case. Less marked changes occurred with inspired concentrations in the range 0.1-0.5%. Reduction in oxygen capacity contributed to the death of some of the dogs. Almost complete reconversion to oxyhemoglobin was accomplished with the administration of methylene blue. In all eight dogs, the only abnormal pigment found was methemoglobin. Nitric oxide-hemoglobin and nitric oxide-methemoglobin are unlikely products of the in vivo reaction of nitric oxide and hemoglobin according to literature. Since no nitric oxide-hemoglobin was formed, it was supposed that the methemoglobinemia that is produced results from nitrite formed as a result of oxidation and hydration reactions.

7212 APTIC NUMBER 16374

Trainor, D. C. and B. C. Jones
HEADACHES IN EXPLOSIVE MAGAZINE WORKERS. Arch. Environ. Health, vol. 12:231-234, Feb. 1966. 6 refs.

The effect of nitroglycerin and ethylene glycol dinitrate exposure on explosives workers was studied. A group of six men submitted themselves to an atmosphere in which nitroglycerin and ethylene glycol dinitrate were present at the maximum allowable concentration (MAC) of 2 mg/cu m. Five of the men showed a fall in blood pressure and developed marked headache within three minutes. Ten volunteers inhaled an atmosphere in which there was a mean concentration of 0.7 mg/cu m for 25 min and all showed a

fall in blood pressure and developed slight headache. Seven volunteers were similarly subjected to an atmosphere in which the mean concentration was 0.5 mg/cu m and all developed mild headache and had a fall in blood pressure within 25 min. It was concluded that the level at which physiological response to nitroglycerin and ethylene glycol dinitrate occurs is considerably below the figure of 2 mg/cu m and that, for this reason, the MAC requires revision. (Author summary modified)

7213 APTIC NUMBER 16177

Uno, A.
THE MORTALITY OF THE AGED IN AN AIR-POLLUTED AREA IN JAPAN. (Taiki osen chiku ni okeru rojin shibo). Text in Japanese. Nichidai Igaku Zasshi (Nichidai Med. J.), 27(5):584-612, May 1968. 81 refs.

The correlation between respiratory and cardiovascular diseases and atmospheric conditions (temperature and humidity) and smoking was investigated by examining the death rate (1962-1964) from the diseases in longtime residents of Kawasaki city, 60 years and older. The collection ratio of the data was 74%. The mortality figures for persons who had lived in polluted areas of the city longer than five years were 345 males (81.59%) and 281 females (77.55%); the figures for residents of the nonpolluted area were 210 males (70.48%) and 208 females (68.15%). The death rate was high in winter and increased even more in summer when SO2 concentrations were highest (in 1963, the maximum SO2 concentration in the industrial district between July and September was 6.405 mg SO2/day/100 sq cm PbO2). In the polluted area, there was an increase in deaths from cardiovascular diseases, especially vascular damage to the central nervous system, and pulmonary tuberculosis. Deaths attributed to respiratory diseases had decreased. In the nonpolluted area, there was an increase in deaths from neoplasm in the respiratory organs and from bronchial asthma. Among smokers the incidence of death from neoplasm in the respiratory organs, arteriosclerotic heart disease, and bronchial asthma was highest in the polluted areas. The deaths are correlated with high humidity, low temperature, and reduced visibility.

7214 APTIC NUMBER 16055

Vaughan, Thomas R., Jr., William J. Moorman, and Trent R. Lewis
CARDIOPULMONARY RESPONSES TO ACUTE OZONE EXPOSURE. THE ROLE OF HISTAMINE. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 24p., 1969.. 30 refs.

Cardiopulmonary responses in acute exposure to ozone, and the role of histamine in tolerance production, was studied. Anesthetized, tracheostomized dogs were exposed to high concentrations of ozone. Mechanisms of physiological responses to ozone were studied by prior vagotomy, prior treatment with a histamine-depleting agent, and concomitant exposure to an aerosol of isoproterenol. Inhalation of 50 ppm ozone produced transient apnea, followed by tachypnea, decreased dynamic compliance (CL), increased pulmonary resistance (RL), mild hypotension, and bradycardia. The apnea occurred after ozone was inhaled for about 2 minutes and lasteed approximately 1 minute. After a 30-60 minute recovery period, re-exposure to ozone failed to produce apnea although the other responses did occur. The apnea, hypotension, and bradycardia could be prevented with prior vagotomy. Pretreatment with compound 48/80 prevented apnea and hypotension, and lessened the degree of bradycardia produced by ozone. Neither prior vagotomy nor pretreatment with 48/80 prevented the decrease in CL or the increase in RL. It is suggested that acute exposure to high concentrations of ozone releases histamine in the lung and thus leads to apnea, hypotension, and bradycardia via a vagal reflex. Decreases in CL and increases in RL were probably partly due to direct effects of ozone on the airways. (Author abstract modified)

7215 APTIC NUMBER 16121

Yoshida, Katsumi, Yoshikazu Takatsuka, Masayoshi Kitabatake, Hidehiko Oshima, and Masayuki Imai
AIR POLLUTION AND ITS HEALTH EFFECTS IN YOKKAICHI AREA. REVIEW ON YOKKAICHI ASTHMA. Mie Med. J., 18(3):195-209, Jan. 1969. 22 refs.

The details of the pollution situation and epidemiological findings in Yokkaichi were described. The most abundantly emitted matter was sulfur dioxide, and its amount reached about 140,000 tons/year. From the frequencies of complaints, mass-screening tests, and direct interviews in certain districts, the growth of bronchial asthma and a parallel increase of chronic bronchitis and pharyngitis was noted. The prevalence of bronchial asthma among the inhabitants of each district was in proportion to the sulfur dioxide level. Yokkaichi asthma cannot be differentiated from the classical asthma with regard to clinical aspects. An important difference was found in the results of skin tests in an investigation of the allergic properties of the asthma. Asthma patients ordinarily have positive results of 40-80% with the extract of house-dust, but in patients with Yokkaichi asthma, the positive rate was the same as that found in non-asthmatic individuals. The Yokkaichi asthma patients also showed negative results with 30 kinds of allergens. The exogenic allergen was not identified. It was concluded that air pollution does not increase the allergic sensitivity in the classical sense, but the Yokkaichi asthma is etiologically different from classical asthma. The results of serum-protein components showed a decrease in albumin and an increase in globulin, especially in non-treated asthmatic patients. These findings coincide with SO2-poisoning. It was suggested that asthma is connected with chronic inflammation. The mechanism of the disease was speculated. It was concluded that air pollution is the cause of the disease, but the substance and mechanism responsible could not be positively identified.

7216 APTIC NUMBER 16001

Zayets, T. I.
INTRACELLULAR DISTRIBUTION OF PROTEOLYTIC ENZYMES IN THE LIVER AND MUSCLES OF RABBIT AFTER THERMAL BURNS. (Vnutrikletochnoye raspredeleniye proteoliticheskikh fermentov v pecheni i myshtsakh

krolkia posle termicheskogo ozhoga). Text in Russian. Doklady Akad. Nauk SSSR, 176(3):735-737, 1967. 11 refs.

Changes in the activity of proteolytic enzymes (cathepsins) in liver and muscle subcellular fractions was studied after thermal burns. The hind legs of rabbits were emersed in water at 97-100 C for 20 sec. The rabbits were sacrificed 5 to 6 days later. Glycerine extracts were made of the liver, and salt solution extracts of the skeletal muscles. A significant increase in the intensity of autolysis was detected, together with an increase in proteolytic activity of tissue extracts as compared to hemoglobin. Proteolytic activity for structural components of liver cells falls in the following descending order: mitochondria, nuclei, fluid. The acceleration of autolytic processes in liver and skeletal muscle after thermal burn is apparently conditioned by an increase in activity of proteolytic enzymes in the cell nuclei and subcellular granules of the cytoplasm.

7217 APTIC NUMBER 16533

Asakawa, Teruhiko
SMOKE DAMAGE AND ITS CONTROL (RESEARCH AND INVESTIGATION IN INTERNATIONAL JOINT COMMISSION). (Engai to sono taisaku - International Joint Commission no kenkyu to chosa). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(2):87-93, June 15, 1965. 8 refs.

The Trail Refinery is located along the Columbia River in an area whose geographical features make smoke diffusion very complicated. The refinery, 15 miles from the U. S. border, is in a valley is surrounded by steep gorges. After zinc and lead refining operations began in 1923, complaints of smoke damage to vegetation were received from Stevens County in the State of Washington. In a five-yr period, the amount of damage was assessed at $350,000, so several countermeasures were undertaken. They included restriction, and even prohibition, of smoke emissions. Concurrently, research on smoke damage was conducted by analyzing the sulfur dioxide component contained in Douglas firs and other trees and the extent of its effect. It was difficult to determine the quantity of sulfur component absorbed by the damaged leaves since sulfurous compounds were also present in the soil itself, some of which were absorbed by the roots of trees. To relate the observed quantity of sulfur of the leaves to the smoke originating in Trail, several analytical experiments were done. These indicated that even weak sulfurous gas concentrations are likely to damage vegetation under the following meteorological conditions: temperatures above 40 F, sunniness, relative humidity above 60%, and wind direction stability. It is recommended that specific gases be emitted at night when plant pores are narrower.

7218 APTIC NUMBER 16368

Barnes, Robert L. and C. R. Berry
SOLUBLE SUGAR AND ASCORBIC ACID CONTENT OF WHITE PINE AND SEASONAL SENSITIVITY TO EMERGENCE TIPBURN. Preprint, Duke Univ., Durham, N. C., School of Forestry and Southeastern Forest Experiment Station, Asheville, N. C., 9p., 1968. 7 refs.

The contents of soluble sugars and ascorbic acid in white pine needles were studied during the early growing season. The objectives were to determine measures of needle maturity and to relate to the seasonal emergence tipburn in white pine to ozone or other oxidants. Studies were conducted at Durham and Bent Creek on four seven-year-old trees and two ramets each of four clones of six-year-old grafts. Tests were made for soluble sugars, soluble carbohydrates, reducing sugars, and ascorbic acid. Growth of needles at Bent Creek appeared to lag 8-9 days behind that at Durham, probably because of the cooler climate at Bent Creek. No tipburn symptoms were observed at Durham which appeared to be an area of relatively clean air. However, injury occurred on sensitive clones at Bent Creek. A general trend of increasing carbohydrate content with season was indicated from Durham samplings. At Bent Creek, a significant increase in carbohydrates was not seen until later in the season, possibly because of the slower maturity and also variations in the weather early in the summer. Reducing sugars increased more rapidly during fair weather and in daytime than did total sugars. Both reducing and total soluble sugars increased during the winter in Durham trees. Qualitative differences in sugar composition were minor during the growing season. Seasonal samplings showed that ascorbic acid increased more regularly than soluble sugars. It is concluded that ascorbic acid content may be a useful indicator of the overall seasonal trend in needle maturity and sugar contents indicative of the physiological condition of white pine foliage on a given day. However, if a change in physiological condition of the needles during a cloudy or rainy period is involved in susceptibility to air pollutant injury, reducing sugar content is probably a more sensitive indicator of condition than total soluble sugars or ascorbic acid.

7219 APTIC NUMBER 15604

Bovay, E. and A. Bolay
DISPERSION OF FLUORINATED GASES IN THE CENTRAL VALLEY. (La dispersion des gaz fluores cans le Valais central). Text in French. Agr. Romande. Ser. A, 4(5):33-36, 1965.

The movement of air masses in the Rhone Valley, based on topography, have a considerable effect on the location and the amount of fluoride pollution from the aluminum plants in the area. A map of the Rhone Valley indicates that the area of greatest pollution seems to be on the south side of the valley near the town of Martigny. Fluoride levels were determined in plants at verying distances from the source of pollution. In general, plants in the Martigny area seemed to have the highest fluorine content; the highest fluorine samples were from trunks of poplar trees in the Martigny area. High levels were also recorded in pear trees, potatoes, and apricots in the same area.

7220 APTIC NUMBER 15838

Bovay, E.
FLUORIDE ACCUMULATION IN LEAVES DUE TO BORON-CONTAINING FERTILIZERS. Fluoride Quarterly, J. Intern. Soc. Fluoride Res., 2(4):222-228, Oct. 1969. 7 refs.

In Switzerland's Rhone Valley, apricot orchards and vineyards exposed to F(-) emissions from aluminum and phosphate fertilizer factories display typical fluoride-induced necroses of the foliage. Up to 600 ppm F(-) in dry matter is present in the plant tissue but, the damage is limited to a few strictly circumscribed, individually owned parcels of land. Field and pot-culture experiments showed that the high F(-) content in the plants resulted from boron-containing combined fertilizers obtained by direct reaction of sulphuric acid or nitric acid upon raw products. A particular chemical combination containing fluorine and boron is formed in the fertilizer during the manufacturing process. The action of this special combination is similar to that of potassium fluorborate. Experiments on beans conducted in a greenhouse with several fertilizers, including the special combined boron-containing fertilizer, proved that F(-) could be partially eliminated by washing the leaves with water. The

boron content of the tissues remained unchanged by washing, suggesting that F(-) penetrates plants through the roots.

APTIC NUMBER 16311

7221

Brennan, Eileen and Ida A. Leone
SUPPRESSION OF OZONE TOXICITY SYMPTOMS IN VIRUS-INFECTED TOBACCO. Phytopathology, 50(2):263-264, Feb. 1969. 12 refs.

Virus-free tobacco plants and those infected with tobacco mosaic virus were exposed to ozone fumigations in an environmental chamber. The objective was to compare the response of normal and virus-infected foliage of tobacco with toxic concentrations of ozone. Twelve nicotiana sylvestris plants, at the 6 to 8-leaf stage, were inoculated with tobacco mosaic virus (TMV), and 12 were maintained as noninoculated controls. Both virus-infected and virus-free plants were then exposed to 0.30 ppm ozone in a fumigation chamber for 3-6 hours. On the day following exposure to ozone, typical symptoms of ozone toxicity always developed on the virus-free plants, but never on those infected with TMV. Shorter time exposure showed less extensive damage to the healthy plants, but again with no apparent damage to plants infected with TMV. Exposure of the virus-free tobacco plants caused visible injury that was accompanied by certain biochemical changes that were not observed in virus-infected plants. An increase in respiration and nitrogen content and a decrease in carbohydrate content of the foliage was observed. The mechanism of protection of virus-infected plants provide against ozone is unknown. The presence of the virus apparently hastens the maturation of the tobacco plants. Other means that increase the physiological age of the leaves may also offer protection.

APTIC NUMBER 16472

7222

Brewer, R. F., F. H. Sutherland, and F. B. Guillemet
THE RELATIVE SUSCEPTIBILITY OF SOME POPULAR VARIETIES OF ROSES TO FLUORIDE AIR POLLUTION. Proc. Am. Soc. Hort. Sci., vol. 91:771-776, Dec. 1967. 9 refs.

The relative sensitivity of various popular rose varieties to fluoride air pollution was studied. Fourteen varieties of hybrid roses were exposed to 2 ppb by weight F as HF for 6 months under controlled conditions in specially equipped greenhouse exposure chambers. All of the varieties used exhibited symptoms of F toxicity, but there was considerable variation in response among the varieties. Dry weights of tops were significantly reduced as a result of the F treatment in most varieties but this reduction in top weight was accompanied by an increase in total linear growth in 3 varieties. Foliar symptoms of F toxicity ranged from mild interveinal chlorosis to severe marginal necrosis. Of the varieties tested, 3 become chlorotic, 5 others exhibited slight to moderate marginal necrosis patterns and the remaining 6 developed both chlorosis and necrosis patterns as a result of exposure to HF gas. An apparent stimulation of shoot growth by exposure to HF resulted in more compact, dwarf-like plants with many weak branches. In some cases this resulted in more blooms per plant, but the flowers produced were of poor quality with short, weak, stems. Most of the F absorbed by the rose plant accumulated in the foliage. Stems and flowers contained one tenth to one twentieth as much F, respectively, as the leaves. (Author abstract modified)

APTIC NUMBER 16360

7223

Brown, Leland R. and Clark O. Eads
FACTORS AFFECTING THE APPEARANCE OF HOLLY OAKS IN SOUTHERN CALIFORNIA. J. Econ. Entomol., 62(1):114-117, Feb. 1969. 5 refs.

The causes of the poor appearance of mature holly oaks, Quercus ilex L, planted along parkways in San Marino, were investigated. Tree foliage was sparse, and there also appeared to be a necrosis and drooping of the small developing shoots. The new terminal growth was associated with the presence of a leafhopper. Six hydraulic sprays of oxydemetonmethyl gave the best control of a leafhopper, as compared to mist sprays of oxydemetonmethyl or hydraulic sprays of DDT. No treatment yielded control of a necrotic tip dieback that was attributed to the leafhopper. Dead trees were felled and examined. Complete girdling by white fan-shaped mycelial plaques under the root bark and on the root bark, black shoestring rhizomorphs of the oak root fungus Armillaria mellea, were observed. Hot, dry weather, and the possible interaction of smog, also had very obvious effects o the appearance of the trees. Following a smog alert, the trees had an obvious reddish-brown hue added to their overall dark green appearance. It was not possible to correlate the appearance of the trees with the irrigation practices of the property owner but the soil under the tree was dry and dusty. The most important interacting factors contributing to the decline of the oaks, and their death in some cases, was found to be, in probable order of importance, root rot infection; inadequate irrigation; hot, dry, smoggy weather; and the necrotic dieback.

APTIC NUMBER 16358

7224

Costonis, A. C. and W. A. Sinclair
RELATIONSHIP OF ATMOSPHERIC OZONE TO NEEDLE BLIGHT OF EASTERN WHITE PINE. Phytopathology, 59(11):1566-1574, Nov. 1969. 25 refs.

A common needle blight of eastern white pine was found in field and laboratory studies to be a syndrome of acute and chronic ozone injury. Natural occurrences of acute symptoms on susceptible field and potted trees were often related to specific prior increases in ambient ozone concentration. Detection of this relationship required needle elongation, so that new loci of injury could be distinguished from older ones. Ozone, administered at time-concentration combinations monitored in the atmosphere of a rural pipe stand (3 pphm for 48 hr to [illegible] pphm for 4 hr), caused acute injury to current-season needles on field and potted trees. When sensitive trees were fumigated in a polyethylene chamber in constant mist and sunlight (about 1.32 cal/cu cm per min) at 32-38 C, they were consistently more severely injured than when fumigated with the same concentration of ozone without mist under a variety of other environmental conditions. New needles of sensitive field and potted trees remained nonsymptomatic when confined in polyethylene bags or when grown in charcoal-filtered

air. Acute symptoms of ozone injury on sensitive needles of the current season arise as silver flecks caused by collapse of individual mesophyll cells beneath the stomatal surfaces of the needles. These may coalesce to form yellow to pink spots, necrotic bands, and tip necrosis. Chronic symptoms are chlorosis and premature casting of the older foliage and slow growth of trees. Individual trees vary greatly in susceptibility to ozone injury. Susceptible trees are more sensitive during a 6- to 8-week summer period when needles of the current season are elongating. (Author abstract modified)

7225 APTIC NUMBER 16270

Cruz, J. A. Machado
A FEW RESULTS OF HISTOCHEMICAL ANALYSIS IN THE STUDY OF HEAVY METAL ICHTYOPATHOLOGY. (Sur quelques resultats de l'analyse histochemique dans l'etude de l'ichtyopathologie des metaux lourds). Bull. Office Int. Epizoot., 65(5-6):715-717, 1966. 5 refs. Translated from French. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 3p., Aug. 10, 1969.

The pathogenic action of heavy metals on fish was considered as only an external action, primarily affecting the gills. Histochemical studies of the pathogenic action of heavy metals on fish showed that this was not so. Experiments were conducted in which fish were placed in distilled water containing various quantities of iron and lead (from 5-100 mg of metal/l) during extremely varied periods from 5 min to 4 days. The techniques used in histochemically tracing the metals were Turnbull blue for iron, ammonium sulfate and sodium rhodizonate for lead. Metals were found in large quantities on the gills, in the digestive tract, either in the intestinal opening or in an intra-cellular state, and in the liver and kidney. It was concluded that histochemical examination of fish organs is important whenever metallic pollution is suspected and a precise diagnosis is sought.

7226 APTIC NUMBER 16096

Dodd, N. J. F. and M. Ebert
FREE RADICAL REACTIONS MODIFY CELLULAR DAMAGE. Nature, 221(5187): 1245-1246, March 29, 1969. 8 refs.

The properties of molecular species which are responsible for cell death in spores after irradiation were studied. Radical groups were recognized by their response to nitric oxide and oxygen and titrated with these gases using both physical and biological endpoints. Doses for ESR observations were 500 krad and those for survival experiments varied from 1-10 krad given at 200 krad/min and 3 krad/min respectively. ESR signals were ascribed to five different radical groups. Groups I, II, and III were observed within 10 min of irradiation in N2, O2, and NO. In N2, group I decays. In O2, group I, II and possible III decay, while group IV grows at the expense of the others. In NO, all but the resistant group V decay. Group V radicals are recognized only after decay of the other groups. The inactivation constant for anoxic irradiation was increased by O2 post-treatment giving full oxygen enhancement. In corresponding ESR experiments this treatment initiates the formation of radical group IV and reduces total radical population. Group I is not involved in the formation of IV, but may be responsible for anoxic damage. Group IV is correlated with the oxygen enhancement and may contain peroxy radicals. Post-treatment with NO only removes the potential for oxygen enhancement. Corresponding ESR experiments suggest that NO prevent further biological damage by removing radical groups I, II, and III. Although NO removes group IV, it does not reduce the damage already caused by O2. NO and O2 interact faster with the potential for oxygen enhancement during irradiation than in post-irradiation treatment. Rates measured by ESR were slower than those found biologically. This suggests that the groups are heterogeneous. The radicals of biological importance in groups I and II react faster with O2 and NO than those of lesser importance. Evidence showed that the potential for oxygen enhancement does not reside only in initially produced species but can be handed onto daughter species. Radical group IV species responsible for oxygen enhancement, whereas group I includes those responsible for irreversible damage produced in anoxic conditions.

7227 APTIC NUMBER 16617

Dost, Frank N., D. J. Reed, and C. H. Wang
INORGANIC FLUORIDE PROPELLANT OXIDIZERS. VOLUME II. EFFECTS UPON MICROORGANISMS, FISH, AND PLANTS. Oregon State Univ., Corvallis, Science Research Inst., Contract AF 33(615)-1767, Proj. 6302, Task 630204, AMRL-TR-187 (vol II), 59p., Nov. 1968. 7 refs.
CFSTI, DDC: AD 684176

The effects of the inorganic fluoride oxidizing agents (chlorine trifluoride, chlorine pentafluoride, bromine pentafluoride, oxygen difluoride, nitrogen trifluoride, and tetrafluorohydrazine) upon selected species of microorganisms, fish, and plants were studied. Interhalogens were directly injected into water in a closed vessel to provide a reaction mixture. The biological activity of accidentally released chemical agents cannot be studied without considering their reactions with soil, the atmosphere, and the aqueous phase of the environment. Whether gaseous intoxicants can contact biological species resident in aquatic media or soil depends on the probabilities of dispersion of any given gas and for its affinity for and/or reactivity with the physical substrate. Each of the compounds studied is a candidate oxidizer for missile propulsion. In acute exposure of less than 1 hour, the interhalogens, as gases, were destructive to plants at atmospheric concentrations of 10-30 ppm; in aqueous solution, they were lethal to fish and microorganisms at concentrations of 10-25 micrograms fluoride per milliliter. The latter effects resulted from formation of inorganic acids and various oxidizing species, either of which is lethal alone and which can be neutralized by basic compounds and reducing agents and by filtration through soil. Oxygen difluoride was toxic to plants at concentrations in air as low as 1.5 ppm over a 30-min exposure period but had no effect upon aquatic species. Nitrogen trifluoride and tetrafluorohydrazine are nearly innocuous to nonmammalian organisms. (Author abstract modified)

7228 APTIC NUMBER 16632

Efler, J.
EFFECT OF INDUSTRIAL EMISSIONS ON GROWING SPRUCE STANDS IN RELATION

TO DIFFERENT TYPOLOGICAL UNITS. (Vliv prumyslovych exhalatu na dospivajici smrkovy porost se zreteles na rozdilne typologicke jednotky). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. IX-1 to IX-24. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

The problem of smoke damage in a fellable spruce stand with respect to various typological units is discussed. The investigation was carried out in the forest of Vysoky Sneznik which belongs to the sandstone region of Bohemian Switzerland. In the localities containing the individual types, basic rating data, health conditions and quality of trees, their height pattern, and size of crowns were studied. From each typologic unit, 40 borings were taken by means of a Pressler borer from 20 centrally located trees. The tree ring analyses of these borings were performed with the Eklund apparatus with a plotting adapter. The soil condition of the individual types were investigated by six soil probes. The age of spruce stands in the long-term research area, ascertained by borings, was 75 years. Injuries to trees due to industrial exhalations, smoke injury, tree mortality, distribution of thickness growth increments in trees with various degrees of smoke injury, and comparison of relative thickness growth increments in individual units were graphed. It was established that smoke injury, mortality of the trees and decrease in growth are much greater on exclusively podzol and gley soils than on ochre soils and moderately podzol soils. It is indicated that the smoke damage does not appear to be uniform in various localities. The investigation raised the need for adapting forest management in smoke damage areas to the particular features of the locality.

7229 APTIC NUMBER 16152

Garber, Kurt
A STUDY OF THE INTAKE OF TOXICANTS THROUGH THE BARK OF TREES. (Ueber die Aufnahme von Schadstoffen durch die Rinde der Baeume). Text in German. Wiss. Z. Tech. Univ. Dresden, 11(3):549-552, 1962. 12 refs.

The retention of fluorine and its compounds in the bark of trees is discussed. Analysis of the barks of willows, poplars and alders stemming from the vicinity of a superphosphate plant showed considerable amounts of fluorine; hardly any traces were found in the wood. The quantitative analysis of fluorine by perchloric acid distillation showed that a relationship exists between the fluorine content in the bark and the distance of the emission source. Gassing experiments with hydrofluoric acid on three-year old barren trees and cut branches in the winter showed that the fluorine content rose to between 33 and 65 mg in 100 g dry substance, depending on the exposure time; 1.71 to 4.28 mg fluorine was found in the wood. In non-exposed trees, fluorine concentrations of 0.9 to 1.6 mg in the bark and 0.2 to 0.3 mg in the wood were found. A further series of gassing experiments with trees during the winter period showed that the fluorine content of the leaves was twice or three times as high as that of non-exposed trees. Maple leaves from trees whose bark was treated with a 2% sodium fluoride solution also showed an increased fluorine concentration. Trees in the vicinity of a tar and asphalt plant stored higher concentrations of tar containing substances in the bark and, to a less extent, in the wood. Barren trees in the winter were exposed to ammonia. NH3 could be found in the bark; it was not found in the wood.

7230 APTIC NUMBER 16150

Garber, K.
THE IMPORTANCE OF AIRBORNE SALT AEROSOLS TO PLANTS. (Ueber die Bedeutung der Salzaerosole in der Luft fuer die Pflanzen). Text in German. Zentr. Aerosol-Forsch. (Stuttgart), 12(1):24-33, June 1964. 29 refs.

Plant damage, observed after heavy storms on the coast of the North Sea, raised the question of possible injury by salt aerosols. The present knowledge of the effects of salts on plants is discussed. Numerous papers point out that sodium fluoride in 0.2% solution kills the leaves of trapa, elodea and vallisneria within 24 hours, and a 0.025% solution has an adverse effect on germination. NaCL solutions (0.5 to 1%) cause hardly any injury, while KCl in 0.25 to 0.5% solution injuries bean plants; KHCO3 in 0.01 and 0.025% solution is toxic. Ammonia may harm plants in liquid as well as in gaseous states; NH4OH is harmful even in 0.01% solution. As has previously been pointed out, Cl, Na, Mg, Ca, K, NH3-N,B, etc. in weak concentrations serve as plant nutrients. The sensitivity of the various plants to salt solutions differs. Of the most common plants cultivated in Germany, summer barley is least sensitive; beans are highly sensitive; and leaves of plum trees are particularly sensitive. To test whether salt aerosols are as damaging as salt solutions, test plants were exposed for half an hour to the following salt aerosols in 5% solutions: Na2CO3, K2SO4, NaNO3, NaCl, NaF and sea salt. Of these, NaF, NaCl, and sea salt had an injurious effect. The leaves were burned on the rim and began to roll up. NaCl discolored the needles of the picea excelsa. A table lists in detail all injuries observed on the various plants tested (begonia semperflorens, valerianella, gomphrena, lupinus luteus, picea excelsa).

7231 APTIC NUMBER 16222

Guderian Robert, Hans Van Haut and Heinrich Stratmann
EXPERIMENTAL STUDIES OF PHYTOTOXIC HYDROGEN FLUORIDE CONCENTRATIONS. (Experimentelle Untersuchungen ueber pflanzenschaedigende Fluorwasserstoff-Konzentrationen). Text in German. Forschungsber. Landes Nordrhein-Westfalen, no. 2017:54p., 1969. 48 refs.

The resistance of important plant cultures to hydrogen fluoride and the HF concentrations which cause plant injuries at long-term exposure were determined. The test plants were exposed to certain HF concentrations in small plastic greenhouses. Studies of the resistance of certain agricultural and forest plants lead to the formation of various resistance groups which are important for diagnosis as well as for the selection of plants for cultivation

in HF polluted areas. For diagnosing purposes, the resistance groups were established with respect to leaf resistance; the yield was used as a criteria for establishing resistance groups in the planning of plant cultures. Tuberous plants e.g., tulips, crocusses, narcissas, etc., are not suitable for cultivation in HF polluted areas. Peas, beans and lupines showed a higher yield reduction than oats, corn, and summer rap. HF pollution might lead to drastic changes, such as reduction of less resistant plants which in turn enhances the growth of resistant species. Concentrations of 1 to 2 microgram HF/cu m caused severe injuries in tuberous plants after several days of exposure. In grasses and various types of clovers, a fluorine accumulation of 9 mg/100 g dry substance was found at a 16 day exposure to an average concentration of as little as 0.85 microgram HF/cu m. Winter barley showed a yield reduction after 12 days of exposure to 3.3 microgram HF/cu m. Oats, lupines, and peas showed a growth retardation at concentrations above 4 microgram HF/cu m. Spruces, Weymouth pines, Japanese lark, and Nordmann hemlocks began to show needle injuries after several days of exposure to concentrations between 1.5 and 4 microgram HF/cu m. Older leaves generally showed higher fluorine accumulations than young ones.

7232 APTIC NUMBER 16401

Guderian, Robert and Heinrich Stratmann
OUTDOOR EXPERIMENTS ON THE EFFECT OF SO2 ON VEGETATION. III. LIMITS OF SO2 EMISSIONS HARMFUL TO FRUIT AND FOREST CULTURES, AS WELL AS TO AGRICULTURAL AND GARDEN PLANTS. (Freilandversuche zur Ermittlung von Schwefeldioxidwirkungen auf die Vegetation. III. Teil. Grenzwerte schaedlicher SO2 Immissionen fuer Obst-und Forstkulturen sowie fuer landwirtschaftliche und gaertnerische Pflanzenarten). Text in German. Forschungsber Landes Nordrhein-Westfalen, no. 1920, 114p., 1968. 30 refs.

After extensive preliminary studies of the emissions and of the atmospheric pollutant concentrations in the vicinity of an iron-ore roasting plant, six sites with comparable climatic growth conditions and staggered air pollution concentrations were selected to test the injurious effects of SO2 on rye, wheat, barley, rap, potatoes, alfalfa, clover, or tomatoes, etc. as well as on oaks, beeches, spruces, pines, firs, and on cherry, apple and plum trees. Five stations were within the range of the SO2 emission source, while the sixth (control) station was outside the area. All plants and trees were grown in wooden containers to assure the same soil conditions. The SO2 content was measured continuously during 1959-61. Criteria for injuries to forest trees were the number of shoots and the amount of circumferential growth; criteria for fruit trees and field and garden crops were fruit quality and the yield. The reactions observed on all plants are presented in the form of tables and graphs. A differentiation is made between actual injuries, injuries probably caused by air pollution, and possible injuries. The highest value at which no symptoms were observed and the threshold value to visibly harmful SO2 were determined. It was found that barley, summer wheat, summer rap, tomatoes and beets could by grown at average SO2 concentration of 0.59 ppm (0.141 ppm during the measured period), but not fruit trees, forest trees, alfalfa, clover, spinach or winter rye, etc. Fruit trees began to grow at SO2 average concentrations of 0.26 ppm. Spinach was most sensitive to SO2.

7233 APTIC NUMBER 16092

Halbwachs, Gottfried and Josef Kisser
DWARFISM IN PIRS AND BIRCHES CAUSED BY SMOKE IMMISSIONS. Centralblatt fuer das gesamte Forstwesen, 84(2-6):156-173, 1967. 34 refs. Translated from German. 29p.

A morphological and anatomical study of dwarfed varieties of Norway spruce and birch was made. Dwarfism was exclusively caused by the effect of fluorine containing emissions. This influence was exerted directly on the needles and leaves wherein the development was inhibited and the numbers were reduced as a consequence of chronic and acute damage. The metabolism was directly reduced as well as the assimilation performance of the cells that remained intact. The establishment of trees was only possible because of the protecting influence of the neighboring vegetation of lower plants. As soon as individual branches began to grow above this protecting layer, they reached the immediate zone of influence of emissions and died off. This process, repeated every year, prevents a height gain and leads to a dense, bushy growth. The shape of the dwarfed birch is caused by elongation of basal buds. The size of the needles and leaves was greatly reduced particularly on the weather side which was in direct contact with the fluorine emissions. The reduction was due to a decrease in number as well as the size of the cells. Both varieties had considerably more pitch rays which were considerably lower in height. The number of ray cells per unit area was increased as compared to normally developed spruce trees. With birth, this was not found; however, the ray cells were generally narrower and lower. Further study is needed to learn whether such changes in the number of ray cells per surface unit are specific only for coniferous trees or whether they represent a general characteristic of the wood structure of dwarfed tree forms due to different factors.

7234 APTIC NUMBER 16362

Hibben, Craig R.
OZONE TOXICITY TO SUGAR MAPLE. Phytopathology, 59(10):1423-1428, Oct. 1969. 36 refs.

Sugar maples exposed to ozone under laboratory and field conditions were less sensitive to ozone than Pinto bean seedlings. The threshold level for visible injury to maple foliageafter short exposures was 20 to 30 ppbm for 2 hr. Extended intermittent domes as low as 10 ppbm at 2 hr/day for 14 days caused slight injury. Trees treated in the field were injured by ozone only slightly less than potted trees treated under artificial conditions, but understory saplings in the shade were not injured by a high dose. There was great tree-to-tree variability in sensitivity. Ozone caused disruption and collapse of palisade parenchyma cells and adaxial flecks in the vein islet tissue; bifacial scorch developed following exposure to higher doses. Immature leaves were not injured by high doses. Ozone caused leaf abscission only after severe injury by the higher doses. It sometimes induced chlorosis on field trees but never caused twig dieback. Total lipids in some ozone-injured cells were reduced, but no gross changes in the lignin, cellulose, pectic, or starch constituents of the cells were detected. There was no evidence of natural ozone

damage to trees when the external and histologic symptoms induced experimentally were compared with those observed on sugar maples growing in urban and roadside environments. It was concluded that ozone is not an important causal factor in the etiology of sugar maple dieback. (Author abstract modified)

7235 APTIC NUMBER 16245

Hill, A. C., L. G. Transtrum, M. R. Pack, and W. S. Winters
AIR POLLUTION WITH RELATION TO AGRONOMIC CROPS: VI. AN INVESTIGATION OF THE 'HIDDEN INJURY' THEORY OF FLUROIDE DAMAGE TO PLANTS. Agron J., 50(9):562-565, 1958. 15 refs.

Moscow and Loren Blood tomato plants were injected with hydrogen fluoride for approximately four weeks, and the effect of fluoride exposure on the photosynthetic rate, respiration rate, and chlorophyll contents of the plants were determined. The fluoride concentrations used were higher than are likely to be encountered around fluoride-emitting factories. Extremely high fluoride levels accumulated in the foliage under high fluoride treatment, but only small amounts in the fruit and peeling. The fluoride treatment, even at the highest levels, did not affect photosynthetic rates. Growth and vigor of thy plants were excellent under all treatments, while fruit size and set were good. Plant height was unaffected. The chlorophyll contents of the leaves and the respiration rate of the treated plants were not significantly higher than in control plants. The results strongly indicate that hidden injury to crops does not occur at the levels of gaseous fluoride present in the atmosphere around modern industries.

7236 APTIC NUMBER 16387

Hill, A. C. and M. R. Pack
OCCURRENCE OF FLUORIDE IN PLANTS AND ITS EFFECTS. Preprint, 72p., 1960 (?). 113 refs. (Published as a chapter in the book 'A Summary and Evaluation of the Problem of Air Pollution With Fluoride'. C. S. Brandt (ed.), U. S. Dept. of Agriculture.)

The available data on the relationship of atmospheric fluorides to plants is reviewed and evaluated. Fluoride occurs naturally in plants but is present in elevated levels in locations near certain industrial emitters. In contrast to the relatively low amounts of fluoride normally taken up from the soil, leaf concentrations of several hundred ppm have been reported for crops near fluoride emitters, entering the leaf primarily through the stomata. The rate of accumulation is apparently proportional to the atmospheric concentration of fluoride; the amount of flucride in the plant is directly related to the exposure factor CT (concentration times time). The amount of fluoride deposited on or absorbed by the vegetation on a given area of lead during a given time period tends to be constant; therefore, the greater the amount of vegetation present, the lower its probable fluoride concentration. Accumulation varies with species; tomato, potato, raspberry, carrot, larch, and pepper leaves show high levels while pine, fir, corn, laurel, rose, and gladiolus tend to be low. Rain is effective in reducing the fluoride content of vegetation; other sources of loss are under study. Samples collected in connection with injury studies are generally limited to the leaves, the [illegible] site of damage. Periodic sampling of the forage being [illegible]ed by livestock is essential. Sampling methodology, the [illegible]ribution of fluoride within the plant, and variables affecting [illegible] susceptibility are discussed. Atmospheric fluoride concentrations in emitting locales usually average from a few hundredths to 2 or 3 micrograms/cu m. The forms emitted include hydrogen fluoride, cryolite, calcium fluoride, and silicon tetrafluoride. It appears that gaseous fluorides are much more phytotoxic than particulate emissions. In general, the gross symptoms of fluoride injury consist of necrotic leaf lesions; other signs of damage are reviewed in some detail for various types of plants. The effects of fluorides on growth and yield, tissue destruction, photosynthesis rates, inhibition of enzymes, respiration, and chlorophyll are discussed, and suggestions for future research are made.

7237 APTIC NUMBER 16273

MacKnight, Martha L.
THE EFFECT OF OZONE ON STOMATAL APERTURE AND TRANSPIRATION. Utah Univ., Salt Lake City, Dept. of Botany, Thesis (MA), June 1968, 80p. 153 refs.

The effects of ozone on stomatal movement and transpiration were investigated. Several species of plants were fumigated with ozone, and stomatal aperatures were measured from leaf surface impressions. Attached trifoliate leaves of Pinto beans were enclosed in a small leaf chamber and were fumigated with ozone. The transpiration rate of the enclosed leaf was measured by determining the difference in the relative humidity of the air before entering, and after leaving, the leaf chamber. Ozone was observed to cause stomatal closure and the degree of closure varied with the different plant species. Since the degree of stomatal closure for a given species varied inversely with the amount of damage which subsequently appeared on the leaves, such ozone-induced stomatal closure may afford the plant some measure of protection from damage by reducing further entrance of the toricant into the leaves. A 30-minute fumigation with 20-40 pphm ozone caused a decrease in the transpiration rate of Pinto bean leaves. Such a decrease in transpiration was inevitably followed by the appearance of visible leaf damage. The age of the trifoliate leaves was the most important factor in determining whether an ozone-induced decrease in transpirate rate would be observed for a given leaf. Young (3-8 days) and old (31-46 days) leaves showed no transpiration decrease in response to ozone, whereas the medium aged (19-24 days) leaves invariably displayed such a decrease. The extent of the reduction in transpiration rate was dependent upon ozone concentration, the season of the year, and the intensity of light prior to fumigation. The time of fumigation during the day, the initial transpiration rate, the soil moisture, and the presence of artificial lighting during growth, seemed to have no effect on the extent of the transpiration decrease. The amount of visible damage appearing on the leaf was related to light intensity during and after fumigation, ozone concentrations, and the season of the year. Leaf temperature was observed to be inversely related to the transpiration rate. (Author abstract modified)

7238 APTIC NUMBER 16178

Maeno, Michio
SOME PROBLEMS RELATED TO THE SELECTION OF SMOKE-RESISTANT TREES AND MANAGEMENT OF GREEN ZONES IN THE AREA OF AIR POLLUTION. (Taienseijusoku no sentei to kogaikanshc ryokuchi nikansuru ni-san no mondai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(5):271-279, May 15, 1968. 25 refs.

Data for urban air-pollution control and forest conservation programs were gathered by studying the relationship between tree damage in metropolitan areas and industrial pollutants. Waste gases were found to cause both acute and chronic plant damage. The former is the result of brief contact with relatively high concentrations of gas: its symptoms are the destruction of cells between leaf veins or at leaf edges. The damaged area turns white, lead, or ivory. If they produce anthocyanin, the leaves appear brown or red-brown. Depending on the type of plant and the length of contact with the gas, the necrotic markings appear in the shape of stripes or belts. Chronic damage is the result of long periods of contact with low concentrations of gas: its symptoms are those of chlorosis due to chlorophyll destruction. In practice, the distinction between acute and chronic damage is difficult. It is suggested that mature forest trees and fruit trees be used as indicators of plant damage. Problems relating to the selection of smoke- and salt-resistant green trees for reclaimed coastal areas are discussed.

7239 APTIC NUMBER 16567

Martin, J. P. and P. Jacquard
INFLUENCE OF FACTORY SMOKE ON LICHEN DISTRIBUTION IN THE ROMANCHE VALLEY (ISERE). (Influence des fumees d'usines sur la distribution des lichens dans la vallee de la Romanche (Isere)). Text in French. Pollut. Atmos. (Paris), 10(38):95-99, April-June 1968. 15 refs.

Four manufacturing plants produce pollutants in the Romanche Valley, between Le Roure-d'Oisans and Vizille; one produces hydrogen fluoride and three produce particulate matter. The plant farthest down the valley produces calcium carbonate and gives off smoke, the solid matter of which consists of 50% calcium oxide and oxides of magnesium, silicon, iron, aluminum, and carbon. The second and fourth factories produce ferro-alloys and calcium carbonate and have similar pollutants. The third factory is an aluminum plant and produces fumes of hydrogen fluoride and other fluorides. Micrometeorological studies showed that the direction of the smoke was usually up-valley, with local and minor variations. The pH of the snow fall in the region of the factories averaged about 10, with values of 11.2 and 12.2 registered during February 1965 and December 1966. The pH of the rain averaged 10, and the pH of the bark of trees growing near the factories was also alkaline. Bark from similar trees near Grenoble had an acid pH. Rock surfaces in the area were covered with a gray-blue patina. Three zones of lichen growth were identified: poor growth of toxitolerant and coniophile lichens, up to approximately 500 meters from the factories; a transition zone; and a 'normal' zone, the boundaries of which varied within wide limits, but were approximately 1 km from the factory. Growth in the third zone corresponded to that in non-polluted areas. A list of lichen species identified is presented.

7240 APTIC NUMBER 16226

Materna, Jan
DETERMINATION AND PREVENTION OF AIR POLLUTION DAMAGE TO FORESTS IN THE CZECH PART OF THE ERZGEBIRGE. (Forstliche Massnahmen zur Erfassung und Verhuetung von Waldrauchschaeden im tschechischen Teil des Erzgebirges). Forst Holzwirtschaft, 15(13): July 1960. 7 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 10p., Oct. 1, 1969.

Spruce trees in the forest areas of the Erzgebirge were found to be extensively damaged by sulfur dioxide present in smoke from open coal pits and coal processing plants. Trees located in exposed areas such as ridges and plateau swamps were especially sensitive. Atmospheric sulfur dioxide concentrations of 14.90 mg/cu m were recorded. Soil investigations showed acidification of the humus layer and of the top layer of the mineral soil. Sulfur concentrations in the soil reached up to 384 mg SO3 per kg soil. Zinc, lead, and chromium were also present in concentrations exceeding critical values. Countermeasures indicate the efficiency of stone meal, primarily basalt meal, in promoting tree resistance to sulfur dioxide and of calcium and nitrogen fertilizers in improving the quality of the humus soil layer. Since the silicic acid concentrations are always high in the needles of injured spruces, it is thought that this compound might be a useful indicator of plant damage.

7241 APTIC NUMBER 16255

Miyazaki, Sakaki, Tetsukazu Okinaga, and Minoru Harata
THE EFFECT OF FERTILIZER ON THE GROWTH OF BLACK LOCUST (ROBINIA PSEUDOACACIA, L.) SEEDLINGS TRANSPLANTED IN KOSAKA BARE LANDS INJURED BY THE STRONG SULPHATE SMOKE. (Kosaka kozan no engaichi ni okeru niseakashiya no shihi shokusai shiken). Text in Japanese. Ringyo Shikenjo Aomori Shijo Gyomu Hokoku, no. 1:1-10, Nov. 1954. 5 refs.

The characteristics of the soil at Otarube, Kosaka town, Akite prefecture, which continuously suffered from strong sulfite smoke from the Kosaka smelting works, were described. The effects of the correction of acidity in soil by lime or the application of various nutrients to the soil and the growth of black locust seedlings was investigated. The black surface soil consists of an A horizon derived from andesitic volcanic ashes. Below that is the A' horizon which is relatively thick and rich in humus. Between the two horizons, a yellowish brown, small pumic stone layer is located which is about 12 cm thick. The yellowish brown layer was markedly acidic when reacted with 102.2 of Daikubara's exchange acidity. Strong sulfite smoke over a period of many years may have produced the acidity, which causes weak leaching of some sesquioxide or bases in the soil. As the acidity of the soil was corrected by a supply of lime,

the manure, potassium, phosphate, or nitrogen fertilizer was applied to the soil separately or combined, the growth of the transplanted black locust seedlings increased in proportion with the amount of treatment. No effect was observed in non-treated soil. Therefore, it was concluded that the soil became oligotrophic by smoke. It was also discovered that granular or small block-like ball fertilizers are very valuable for the growth in the top or the root system of black locust seedlings. It was also observed that the better the growth of the black locust seedlings, the less the smoke injury to them.

7242 APTIC NUMBER 16327

Okamoue, Masao
OF AN INJURY TO AKAMATSU (PINUS DENSIFLORA SIEB. ET ZUCC.) FOREST IN THE VICINITY OF THE SMELTING WORKS AT HITACHI. (Showa 30 nen 7 gatsu takahagi eirinshonai ni hassei'shita engai nikansuru chosahokoku). Text in Japanese. Ringyo Shikensho Kenkyu Hokoku, no. 105:141-147, March 1958. 3 refs.

In the summer of 1965, smoke from a smelter at Hitachi caused injury to a national forest approximately one to three km distant. The smelter had been equipped with control devices and no previous injuries had been reported. An investigation of meteorological conditions at the time of the emission revealed the presence of a temperature inversion between Mt. Kamaine (594 m) and Sukegawa (52 m). However, these inversions are not uncommon in the area. Presumably, poisonous gas was emitted from the smelter chimney as a result of equipment malfunction just at the time of unfavorable meteorological conditions. (Author abstract modified)

7243 APTIC NUMBER 16357

Otto, Harry W. and Robert H. Daines
GENESIS OF PHYTOTOXIC AIR POLLUTANTS AND THEIR IDENTIFICATION AND MEASUREMENT BY CHEMICAL AND PHYTOLOGICAL METHODS. IEEE (Inst. Elec. Ectron. Engrs.) Trans. Geosic, Electron., GE-8(1):59-69, Jan. 1970. 105 refs. (Presented at the First Annual International Geoscience Electronics Symposium, Washington, D. C., April 1969.)

Phototoxic air pollutants derived from bombustion of fossil fuels and from subsequent photochemical reactions in the atmosphere are discussed. Among the major pollutants that adversely affect vegetation are sulfur dioxide, ozone, peroxyacyl nitrate (PAN) and analogs, nitrogen oxides, and ethylene. The chemical methods currently employed to measure the occurrence of these pollutants frequently lack specificity and sensitivity to specific pollutants. In the absence of collaborative testing, their reliability, precision, and accuracy remain uncertain. Because the plant kingdom serves as a constant atmospheric monitor, the chemical methods should be supplemented by a study of plant response. Each pollutant has its own spectrum of responding plant species and each produces a characteristic response for each species affected. While man-made monitoring devices record exact chemical concentrations unaffected by environmental factors and pollutant mixtures, a plant responds biologically not only to concentrations, but also to all other environmental factors that alter response, i.e., humidity, soil moisture, light, temperature, etc. In addition, the plant also responds to the total impact of the pollution mixture.

7244 APTIC NUMBER 16637

Ranft, H.
EVALUATION OF A PREVIOUS PLANTING EXPERIMENT WITHIN THE RANGE OF THE ZINC SMELTER AT FREIBERG. (Vyhodnoceni starsiho pokusu s vysadbou v dosahu zinkove hute u Freibergu). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emission Forestry, Janske Lazne, Czechoslovakia, 1966, p. IV-1 to IV-15. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

A planting experiment on 10 ha of 40 tree and shrub species which was started i1935 in an area of emission attack from a metallurgical plant at Freidberg in Saxony was evaluated. The experiment was northwest of the plant at 400 m above sea level on a flat plain which slopes eastward to the Hulda valley. The basic stratum is gray gneiss; the soil is medium-to-deep, quite loamy, and exhibits medium sorption and nutrient values. The trees and shrubs were planted in small stands, also in rows and mixed groups, on former agricultural land. The prevailing winds were from southwest to northwest and the growing stands were injured only slightly by the stack gases from the metallurgical plant. After the beginning of the operation of a new zinc refinery which was located a few hundred meters northwest, an increased attack was evidence by SO2, SO3, and iron oxide dust containing waste material. The iron oxide dust did not prove harmful. Short-term measurements gave peak values of more than 1.2 mg SO2/cu m of air. Injuries affecting the size of leaves and fascicles, their color, with necrosis and inhibition of growth of foliage and fascicles was observed. The extent of current damage was determined. Measurements of height and circumference, together with borings, confirmed the more or less large decrease in yields from various representative varieties of woody plant found in the area. Smoke damage on trees and shrubs, based on damage manifestations and yield decrease, were graded and were listed.

7245 APTIC NUMBER 16059

Rozybakiev, N. A. and M. M. Ababkov
EFFECT OF CO, CU AND MN ON THE CONTENT OF TRACE AND OTHER ELEMENTS IN THE SALIVA OF SHEEP. (Vliyanie Co, Cu i Mn na soderzhanie mikroi makroelementov v slyune ovets). Tr. Inst. Fiziol. Akad. Nauk Kaz. SSR, vol. 10:101-105, 1966. 10 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 10p., Sept. 25, 1969.

Trace elements are necessary for the normal course of biological processes. Cobalt affects tissue metabolism, depressing oxidative processes, and non-specifically activating enzymatic metabolism. Copper is a necessary constituent of all cells. Manganese acts on the reproductive capacity of animals and is required for growth. The physiological action of copper, cobalt, and manganese on the content of trace elements and more abundant

elements in the secretion of the parotid glands in sheep was investigated. The experiments were performed in series. In the first series, the separate effect of each element was studied. In the second series, complex supplementation with Cu + Mn + Co was carried out. The elements found in saliva were Na, K, Ca, Si, Mg, Al, P, Cu, Mn, and Ti. The content of Na, K, and Si in the saliva in all series did not change. Introduction of Co increased Ca and Cu content and decreased P, and had no effect on Mn. After Co supplementation was stopped, the content of Ca, P, and Cu in the saliva increased slightly. The addition of Cu increased Mg and Cu content. After Cu feeding was stopped, Cu and P decreased and dropped to the original level. The addition of manganese to the diet has no effect. Combined feeding has no effect on P, Ca, and Mn content of the saliva, but the amount of Cu increased, even after supplementation stopped. Cobalt was not found in the saliva in any of the cases.

7246 APTIC NUMBER 15482

Seidman, Gabriel and Wilson B. Riggan
STOMATAL OPENING IN PINTO BEAN DURING DAYLIGHT HOURS. Botan. Gaz., 130(2):116-118, June 1969. 3 refs.

A year-long investigation of daytime stomatal movements of the primary leaves of 11-day-old pinto bean plants was conducted. New plants were used for each bihourly reading. Light, temperature, atmospheric pressure, relative humidity, time of day, and month of year were the parameters studied. Stomatal opening was measured with a modified Alvim porometer on the eleventh day after planting. Atmospheric pressure, light intensity, temperature, and relative humidity varied during the year in the greenhouse, but in the growth chamber, light and temperature were controlled. Of all the variables, only the coefficients for the month of the year and the hour of the day were important in explaining the size variations in stomata of growth chamber plants. After dawn, stomatal opening increases gradually and reaches a peak at noon in the greenhouse and at 2:00 p.m. in the growth chamber. In the greenhouse, the decrease in stomatal opening at 2:00 p.m. was not statistically different from noon, but the decrease in stomatal size at 4:00 p.m. was statistically different from both noon and 2:00 p.m. In the growth chamber, stomatal opening at 4:00 p.m. was somewhat smaller than at 2:00 p.m., but this difference was not significant. This daily pattern was not explainable in terms of the parameters that were examined in the growth chamber and the greenhouse. Carbon dioxide concentrations, which varied throughout the day, were highest at 8:00 a.m. and lowest at 4:00 p.m. The widest stomatal opening at midday did not correspond to the lowest carbon dioxide concentrations. It was concluded that the findings indicate that endogenous factors probably exert a greater influence on stomatal movement than was demonstrated.

7247 APTIC NUMBER 13431

Srivastava, S. C., M. P. Agrawal, and S. M. H. Jafri
IRON-MANGANESE RELATIONSHIP OF CHLOROTIC SUGARCANE PLANTS GROWN ON A HIGH-LIME SOIL. Soil Sci., 102(3):208-211, Sept. 1966. 5 refs.

The effects of manganese and sulfur spray were studied on chlorotic ratoon sugarcane plants growing on a high lime soil. The treatments consisted of sprays of chelated manganese, ultrasulfur, and water, as a control, with a surfactive agent used in all cases. Observations were recorded on restoration of normal color to foliage, number of clumps recovered, juice quality, and yield of cane. Observations on some soil characteristics and relevant chemical data on soil and plants were also taken. Although the symptoms were indicative of iron deficiency, manganese treatment gave the best response, particularly in improving juice quality. When chlorotic and healthy plants were analyzed, the chlorotic plants were found to be richer in iron but poorer in manganese than the healthy ones. It has been suggested that the inactivation of iron may have been caused by the deficiency of manganese. The development of manganese deficiency in the soils of the region where the disorder is noticed was also discussed. (Authors' abstract modified)

7248 APTIC NUMBER 16091

Steinhubel, G. and L. Halas
THE DESTRUCTION AND FORMATION OF DRY MATTER AT ELEVATED TEMPERATURES INDUCED IN THE LEAVES OF TREES BY DUST EMISSIONS. (Poruchy v tvorbe susiny pri zvysenych teplotach vyvolanych v listoch drevin prasnou imisiou). Lesnicky Casopis, 13(4):365-382, 1967. 18 refs. Translated from Slovak. 22 p.

All solid emissions which settle on the disks of plant leaves affect the leaf activity physically. There may be a connection between heating and the negative after-effects; with the elevation of temperature, there is increased dissimilation of the organic matter through leaf synthesis as a result of a superposed thermal optimum of respiration. The role of variation in the assimilation-dissimilation balance was examined by comparing the gross and net production of dry matter in clean and contaminated leaf disks of the poplar (Populus nigra) and the laurel cherry (Pruna laurocerasus) with reduction of dry matter or with respiration at different temperatures. In each case, the difference between the increase in dry matter in the clean and contaminated leaves was examined under the given conditions in proportion to the elevation in the intensity of the reduction of dry matter or respiration. Those changes are evident even at a temperature difference of 2.5 C, which is taken as the average heating power of the used thickness of the dust layer during thermal radiation. The results indicated that the reduction of the formation of dry matter in the dusted leaves is brought about without the help of soluble toxic components of the deposited dust and that one form of that effect is an unfavorable overheating of the disks, caused by dark ore dust during direct irradiation by the sun. (Author summary modified)

7249 APTIC NUMBER 16244

Thomas, Moyer D.
AIR POLLUTION WITH RELATION TO AGRONOMIC CROPS: I. GENERAL STATUS OF RESEARCH ON THE EFFECTS OF AIR POLLUTION ON PLANTS. Agron. J., vol. 50:545-550, 1958. 39 refs.

Plant damage caused by sulfur dioxide, fluorine compounds, and smog is summarized. Sulfur dioxide causes two types of leaf injury: acute and chronic. The acute markings are marginal or interveinal collapse areas; their color is usually ivory. The chronic markings are areas of limited cell injury but not total collapse; the colors range from yellow to brownish-red to white and represent fumigation treatments or prolonged exposure to low concentrations. No reduction in yields have been demonstrated in plants exposed to sulfur dioxide unless there was leaf injury. The fluoride pollution problem as two aspects: direct injury to commercial and ornamental plants and the risk of fluorosis in cattle and sheep exposed to contaminated vegetation. Hydrogen fluoride and silicon tetrafluoride are extremely toxic to a few plant species. Hydrogen fluoride in ppb concentrations cause lesions resembling those due to sulfur dioxide. Photosynthesis experiments, the results of which are presented in tables and graphs, indicate that each crop has its own threshold limit which varies from 5 ppb for gladiolus to about 500 ppb for cotton. Smog damage to vegation is of two kinds: that produced by London coal smoke or fog containing sulfur dioxide; and Los Angeles smog, which is a mixture of oxidants. California smog injury tends to appear as a band on a leaf. Owing to the presence of organic compounds, ozone damage is rarely found in the field. The question remains open whether leaf damage from London fog is due to sulfur dioxide or to other toxicants.

7250 APTIC NUMBER 16517

Tingey, David Thomas
FOLIAR ABSORPTION OF NITROGEN DIOXIDE. Utah Univ., Salt Lake City, Dept. of Botany, Thesis (MA), June 1968, 46p. 50 refs.

The uptake rate of nitrogen dioxide and its effects on photosynthesis, transpiration, and stomatal closure in alfalfa and oats were studied. Factors affecting the absorption rate, such as concentration of NO2, duration of exposure, light and darkness, were evaluated. The results showed that alfalfa and oats absorbed NO2 from the air in excess of 150 microliters NO2/sq m ground area/min when exposed to 24 pphm NO2. Nitrogen dioxide uptake by alfalfa and oats decreased with time when the plants were exposed to 16 and 24 pphm NO2, but remained constant when the plants were exposed to 8 pphm NO2. In artificial light, the absorption rate of NO2 decreased when artificial light intensity was decreased; but when sunlight intensity was reduced, there was no effect on NO2 absorption. Nitrogen dioxide absorption by alfalfa in the dark was 40 microliters NO2/sq m ground area/min when exposed to 16 pphm NO2 with a gradual increase in the uptake. Oats exposed to 16 pphm NO2 in the dark showed an erratic uptake behavior with no evident trend. Nitrogen dioxide assimilation showed a correlation to light intensity, probably because light intensity influenced stomatal behavior. Carbon dioxide assimilation and transpiration exhibited similar responses. Nitrogen dioxide absorption data indicated that plants under proper conditions should be able to remove a significant portion of NO2 from the air. The concentrations required to cause visible damage to alfalfa was NO2 with 200 pphm in the dark and 400 pphm in the light. Oats required 600 pphm in the light and 800 pphm in the dark. When oats and alfalfa were exposed to 8,16, and 24 pphm NO2 for 4 hours, there was no reduction in photosynthetic rate or transpiration. These same concentrations did not induce stomatal closure. (Author abstract modified)

7251 APTIC NUMBER 16312

Tomlinson, Harley and Saul Rich
RELATING LIPID CONTENT AND FATTY ACID SYNTHESIS TO OZONE INJURY OF TOBACCO LEAVES. Phytopathology, 59(9):1284-1286, Sept. 1969. 10 refs.

Evidence is presented that fatty acid content may be a factor in determining ozone resistance, and that fatty acid content decreases in leaves exposed to ozone. Leaves of Nicotiana tabacum were made more resistant to ozone injury by brushing emulsions of lanolin, desylsuccinic acid, methyl palmitate, palmitic acid, oleic acid, or cottonseed oil onto the adaxial surface. Effects of ozone on plants were produced by exposing them to 1 ppm for one-half to 1 hour. At the concentrations used, these materials neither occluded nor caused abnormal movements of the stomata. There was little difference in the total lipid content of leaves from tobacco plants which were normally ozone resistant or ozone susceptible. However, there were significant differences in their fatty acid content. Among plants of the same variety or from genetically similar varieties, fatty acid content was correlated with ozone resistance. Tobacco leaves exposed to ozone lost 60% of their saturated fatty acids, but only 10% of their unsaturated fatty acids. (Author abstract modified)

7252 APTIC NUMBER 16287

Tomlinson, Harley and Saul Rich
THE OZONE RESISTANCE OF LEAVES AS RELATED TO THEIR SULFHYDRYL AND ADENOSINE TRIPHOSPHATE CONTENT. Phytopathology, vol. 58:808-810, June 1968. 12 refs.

Experiments assessing the importance of sulfhydryl groups and adenosine triphosphate in the ozone sensitivity of leaves are reported. Ozonation lowered the sulfhydryl content of the leaves of beans, spinach, and tobacco. Tobacco and bean leaves treated with sulfhydryl-binding reagents, such as alpha-iodoacetamide and alpha-iodoacetic acid, developed symptoms similar to those produced by ozone. A tobacco variety resistant to ozone was also more resistant to damage from sulfhydryl-binding reagents than was a variety of tobacco susceptible to ozone. With leaves from the same tobacco plant, the older the leaf, the more severely it was damaged by the sulfhydryl-binding reagents. This parallels the pattern of susceptibility to ozone. Ozonation also lowered the ATP content of bean leaves. Bean leaves were made resistant to ozone by allowing them to take up 0.001 M ATP through their petioles before ozonation. On tobacco, the younger, more ozone-resistant leaves had higher concentrations of both sulfhydryl groups and ATP than did the older, more ozone-susceptible leaves. However, leaves of a tobacco variety resistant to ozone contained lower concentrations of both sulfhydryl groups and ATP than did comparable leaves of a tobacco variety susceptible to ozone. (Author abstract modified)

7253 APTIC NUMBER 16313

Treshow, Michael, Frances M. Harner, H. E. Price, and J. B. Kornelink
EFFECTS OF OZONE ON GROWTH, LIPID METABOLISM, AND SPORULATION OF FUNGI. Phytopathology, 59(9):1223-1225, Sept. 1969. 14 refs.

The possible effects of ozone on mycelial growth, spore production, spore germination, and lipid metabolism were determined. Fumigations with ozone at concentrations of 10 pphm or more for 4 hr repeated daily for 4 days suppressed radial growth and spore production of Colletotrichum lindemuthianum, the most sensitive species studied. Neither radial nor mass growth of Alternaria oleraceae, a more tolerant species, was inhibited by 60 pphm ozone, although spore production was significantly accelerated. Since ozone did not affect spore viability, the inoculum potential was greatly enhanced. Histological effects of ozone included loss of pigmentation in C. lindemuthianum and abundant formation of light-refractive globules in the hyphae. Chemical analyses of mycelial mats showed an average 28% decrease in neutral lipid content of ozone-fumigated cultures. No differences were detectable in fatty acid composition of fumigated cultures. While some lipids may have leaked into the substrate, it was suspected that ozone penetrated into vital sites within the cell-oxidizing sulfhydryl groups, thereby suppressing lipid synthesis. The actual degree of suppression in fumigated hyphae may be greater than indicated, since much of the mycelia analyzed grew within the substrate and was not directly subject to ozone. (Author abstract modified)

7254 APTIC NUMBER 16634

Wentzel, K. F.
A PROPOSED DRAFT OF A CLASSIFICATION OF IMMISSION DISEASES. (Navrh klasifikace imisnich chorobenstvi). Scientific and Technical Society, Prague (Czechoslovakia), Agricultural and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. 11-1 to 11-9. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

It is useful to adapt the existing and presently used terminology with respect to plant damage to the advanced knowledge of the art while preserving proven concepts. Designations which can be misunderstood or are unnecessary should be dropped. This is true especially for the terms invisible injury and invisible damage. It was suggested that the concept of injury be replaced with respect to physiologic effects, by disease, because this designation can be understood only in the biological, and not economic, sense. It was further suggested to distinguish between acute and chronic diseases, and also recognize a class of secondary disease, together with two kinds of damage, direct and indirect. In order to differentiate clearly among the concepts involved in the casual chain, fume-damage terminology would thus, in respect to the proposed classification, include 2 forms of effects, 3 grades of disease, and 2 kinds of damage (7 terms in 3 successive influence stages). (Author abstract modified)

7255 APTIC NUMBER 16399

Yamazoe, Fumio
SYMPTOMS AND MECHANISM OF INJURY TO CROPS EXPOSED TO HYDROGEN FLUORIDE. (Fukkasuiso nyoru engai no jittai narabini kisaku nikansuru kenkyu). Text in Japanese. Nogyo Gijutsu Kenkyusho Hokoku, Dojo. Hiryo (Bull. Natl. Inst. Agr. Sci. Ser. B), no. 12:1-125, Feb. 1962. 111 refs.

The effect of hydrogen fluoride on the growth and yield of the main crops of Japan and the typical symptoms and mechanism of injury was studied, as well as a method for reducing injury. A fumigation chamber was built in which several crops were grown in Wagner's pots and exposed to hydrogen fluoride which was colorimetrically determined with aluminum hematoxylin. A significant decrease in yield was obtained with 25 ppm HF for paddy rice or barley and 50 ppm HF for wheat after fumigation for 1 hr. It was also found that the amounts of nitrogen, silicon, and fluorine was related to injury. Injury was more severe under high humidity and in daylight. Symptoms of fluorine toxicity in paddy rice were tip and marginal scorching of the younger expanded leaf, greyish green color of the terminal leaf, and wilting and yellowish brown color after two days. Chlorophyll in the parenchyma was decolorized, cytoplasm and cell membranes were decomposed, and the injured part was chlorotic. The amount of transpired water was reduced, carbon assimilation almost ceased, respiration was accelerated, pH was lower, and nitrogen assimilation was retarded. A recommended method of preventing plant injury was to avoid excessive application of nitrogen fertilizers, add substantial amounts of silica to the nitrogen supply, and spray a lime-suspension at the ear-forming, heading, or flowering stage. The comparison of susceptibility to HF was made with up-land and low-land rice, soybean, rape, garden radish, and Chinese rape. Rape was indifferent, and up-land rice was more sensitive than low-land rice. Soybean was very sensitive; garden radish and Chinese rape showed symptoms of injury at concentrations as low as 10 ppm HF. From the results of infrared absorption and solubility data, it was supposed that flucrine exists chiefly as a slightly water-soluble fluosilicate in the injured part of Gramineae and as a water-insoluble calcium fluoride in Leguminosae or Cruciferae.

7256 APTIC NUMBER 16404

Barton, K. and S. Bartonova
MECHANISM OF THE CORROSION OF FE, ZN AND CU IN A HUMID ATMOSPHERE CONTAINING HCL VAPORS. (Mechanismus der Fe-, Zn- und Cu-Korrosion in feuchter HCl-Daempfe enthaltender atmosphaere). Text in German. Collection Czech. Chem. Commu. (Prague), 32(7):2431-2438, 1967. 6 refs.

Steel containing a small amount of carbon, electrolytic zinc, and electrolytic copper in the form of thin plates 30 by 80 mm with a thickness between 0.8 to 1 mm were used to study the corrosion mechanism at temperatures of 20, 30 and 40 C; a relative humidity of 80%; and an HCl content of 0.0007 to 0.002% (by volume). The stationary state characterized by constant quantity and composition of the corrosion products and a linear dependence of the corrosion on time was established. After the staticnary state had been reached, the corrosion kinetics iron were goverend by HCl formation during the rust development. With the zinc sample, the corrosion speed decreased after the stationary state had been reached. This was due to a reaction of the hydroxide and the alkaline zinc chloride with HCl, where soluble ZnCl2 is formed. The speed of this process is influenced by the transport of the gaseous HCl to the boundary atmosphere/corrosion product, as well as by the adsorption and composition of the product. With the copper sample, the decisive partial process of the corrosion kinetics in the stationary state was the destruction of the CuCl layer covering the Cu20 layer. The process is likewise determined by the transport of the gaseous HCl to the boundary atmosphere/ corrosion product, by the HCl adsorption, and the composition of the product.

7257 APTIC NUMBER 16426

Bombara, G., C. Baudo, and A. Tamba
THERMODYNAMICS OF CORROSION IN FUSED SULPHATES. Corrosion Sci., 8(6):393-404, June 1968. 26 refs.

Thermodynamic diagrams are given for Fe in contact with Li2SO4-K2SO4 eutectic at 600 C. In these diagrams, which are similar to those for aqueous systems and fused chlorides, equilibrium potentials (relative to a conventional reference electrode) are plotted against the activity of the oxide in pO(2-). The diagrams outline the conditions for corrosion or possible immunity of a metal in relation to redox and acid-base equilibria of a sulfate melt. Iron will undergo corrosion when the equilibrium concentration of its ions is greater than 0.000001 M. In this area, corrosion leads to formation of an insoluble (or less soluble than 0.000001 M) product, but the occurence of passivation depends on properties of the oxide film, mainly adherence and coherence. However, passivation is theoretically possible only in basic melts. In the presence of an O2 atmosphere, Fe undergoes corrosion. Nevertheless, the only method of preventing Fe corrosion completely seems to be cathodic protection by polarizing the metal down to potentials within the immunity region.

7258 APTIC NUMBER 16448

Boon, J. W.
THE SEARCH OF CORROSION RESISTANCE AND THE BEHAVIOR OF TEMPORARY PRESERVATIVE MATERIALS. (SECOND REPORT). (Onderzoek naar het corrosieweren de gedrag van tijdelijke preserveermiddelen (tweede rapport)). Text in Dutch. Metall Instituut TNO, Delft (Netherlands), Rept. M68-879, 27p., Nov. 21, 1968.
CFSTI: N 69-21557

Experiments on polished mild steel specimens coated with different layers of corrosion resistant coatings of different thicknesses are presented. Seven coatings called PX1, PX2, PX22, PX7, PX11, PXA, and PXB were used. Coatings PX1 and PX2 are fluids used for protection of cylinders, crankshafts, gears, etc.; PX22 is a bitumen product in benzene; PX7 is a vaseline; and PX11 is a stiff plastic substance. PXA is polyvinyl butral paint and PXB is a commercial paint. The mild steel plates were cut to 15 times 20 cm (for exposure in open atmosphere) and to 5 times 10 cm (for exposure under cover). The surface roughness was 4 to 6 micron. Different thicknesses of the coatings were obtained by spraying the coatings more than once; the plates were weighed before spraying. Experiments were carried out in an open atmosphere, under a roof, and under accelerated conditions. The last experiments were carried out on 5 by 10 cm plates as follows: intermittent exposure in 3.5% NaCl solution with a cycle time of 40 min at room temperature; continuous exposure with a 5% NaCl solution as per ASTM code B 117-64; and continuous exposure in a room at 25 C with water vapor and 0.5 to 2% SO2. Results indicate that coatings PX1, PX22, PX7, and PX11 satisfy the required expectations. Both PXA and PXB are unsatisfactory in open atmosphere. Use of PX7 and PX2 in open atmosphere is also not recommended.

7259 APTIC NUMBER 16340

Fischer, H.
RECOMMENDATIONS FOR THE IMPROVEMENT OF THE TESTING AND EVALUATION METHODS FOR THE PERFORMANCE OF CORROSION TESTS IN THE ATMOSPHERE. (Empfehlungen zur Verbesserung der Pruefteehnik und Untersuchungsmethodik bei der Durchfuehrung von Korrosionsversuchen an der Atmosphaere). Text in German. Technik (Berlin), 24(12): 796-798, Dec. 1969. 9 refs.

The site for corrosion tests must be selected according to the use of the material to be tested. Any influence by nearby buildings, trees, or bushes must be avoided. The samples should be arranged at an angle of 45 degrees to the horizontal; the surface which is to be tested must face the south. The air temperature, relative humidity, amount of precipitation, dust fall, sulfur dioxide and chlorine exposure, wind direction, wind speed, radiation intensity, duration of sunshine, the Na, K, Cl and SO4 ion concentration as well as the pH value must be measured. For the evaluation, such factors as the dust accumulation on the surface, the time of the last precipitations, and the use of a microscope to determine the degree of corrosion are of importance. Measurement of the corrosion depth iss required for any accurate evaluation.



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7260 APTIC NUMBER 16213

Kenyon, C. J.
INSULATOR POLLUTION. A SELECTIVE BIBLIOGRAPHY 1966 - NOVEMBER 1968, 57 REFERENCES. Central Electricity Generating Board, London, England, Information Services, C.E.Bib. 49.3, 16p., March 1969. 57 refs.

A selective, annotated bibliography was compiled for the years January 1966 to November 1968. The sources searched were the information services indexes. References include periodicals and reports, and cover recent research, pollution control methods, test procedures, discharge dynamics, and flashover characteristics with respect to insulators.

7261 APTIC NUMBER 16703

Kerr, Nancy, Mary Ann Morris, and S. Haig Zeronian
THE EFFECT OF OZONE AND LAUNDERING ON A VAT-DYED COTTON FABRIC. Am. Dyestuff Reptr., 58(1):34-36, Jan 13, 1969. 14 refs.

The effect of exposure to O3 and of subsequent washing on the properties of cotton fabric dyed with C. I. Vat Blue 29 has been determined. The color of the fabric decreased in depth and the hue tended towards red. The washing appeared to reduce the rate of fading. The fabric was reduced in strength by the exposure to O3. The largest strength loss was found for samples washed between exposures. Copper number and carboxyl group determinations indicated that chemical modification to the cellulose was small. (Author's Abstract)

7262 APTIC NUMBER 16081

Laengle, Erwin
INVESTIGATIONS OF THE CORROSION-CAUSING PROPERTIES OF VOLATILE ACIDS AND ANHYDROUS ACIDS. (Untersuchungen ueber die metallangreifenden Eigenschaften von fluechtigen Saeuren und Saeureanhydriden). Text in German. Eidgenoessische Technischen Hochschule, Zurich, Switzerland, Thesis (PhD), 1968, 43p. 64 refs.
CFSTI: N69-32307

The corrosion resistances of iron, zinc, aluminum, copper, and lead to chemical attacks from hydrochloric acid, hydrogen sulfide, formic acid, acetic acid vapors, and sulfur dioxide atmospheres were studied. Emphasis was placed on the problems of critical vapor humidity, analytic determination of corrosion products, and the reaction mechanisms. Metal samples were briefly exposed to dry or moist acid vapors during the introductory period and subsequently kept for a longer time in an acid-free atmosphere of differing moisture levels. Results showed that the metal surface was initially attacked in by the formation of a dry or humid saline crust which liquefied through atmospheric water absorption and attacked the metal surface by deoxygenation. Pronounced reactions were observed on iron and zinc surfaces, but the other metals proved relatively corrosion resistant. (Author abstract)

7263 APTIC NUMBER 16215

Mattson, Einar
ALUMINUM IN A POLLUTED ATMOSPHERE. (Aluminium i fororenad atmosfar). Text in Swedish. Tek. Tidskr., 98(38):767-768, Oct. 25, 1968. 11 refs.

An experiment on atmospheric corrosion of carbon steel (FIS 1311), conducted in 1950, showed that the average depth of corrosion after 2.5 yrs of exposure was roughly proportional to the acidity of sulfur pollutants. The corrosion rate in Stockholm was four times that of rural areas. In the city of Kvarntorp, whose atmosphere at the time was especially high in sulfur, the corrosion rate was nine times that of the rural atmosphere. Assuming increased environmental pollution and especially an increased acidity of precipitation, the author recommends the use of aluminum for outdoor construction, since it requires no special coating or maintenance and is available at moderate cost.

7264 APTIC NUMBER 15973

McKee, Herbert C.
EFFECTS OF ATMOSPHERIC POLLUTANTS ON ELECTRONIC EQUIPMENT. Southwest Research Inst., San Antonio, Tex., Industrial Pollution and Analytical Research, 5p., 1969 (?).

Deteriorated electronic equipment from a weapon system was examined by microscopic and chemical methods to determine the chemical mechanisms responsible for corrosion. It was found that cleaning abrasives composed of ground cellulosic material were used on some of the equipment. By providing cellulytic fungus spores and the cellulose needed for their growth, the cleaning material could be a source of potentially corrosive materials. Its use is not recommended in atmospheres of high humidity. Other sources of corrosion were high humidity, ammonia or ammonium compounds evolved by plastic covers, and chloride or hydrogen chloride evolved from defective rubberized fabric gaskets. Corrosion of some units was attributed to the simultaneous action of all the latter factors. It is thought that corrosion would have been less severe, or not a problem, in the absence of any one of these factors.

7265 APTIC NUMBER 16420

Rasch, Rudolf
REFUSE INCINERATION AND SYNTHETIC PACKING MATERIAL. (Muellverbrennung und Kunststoffverpackung). Text in German. Verpackungs Rundschau, 19(10):67-73, 1968. (Presented at the 23rd Arbeitstagung des Instituts fuer Lebensmitteltechnologie und Verpackung, Munich, April 3, 1968.)

The per capita accumulation of refuse per year is about 200 to 240 kg. The specific weight can be as high as 600 kg/cu m (at high ash content) or as low as 200 kg/cu m (at a high amount of packing material). The annual volume per capita ranges from 0.4 to 1.2 cu m. Common disposal methods are sanitary landfills, composting, and incineration, the latter being the safest and most hygienic method. Flue gases resulting from this process

must be cooled to 250 C for cleaning. Incineration of synthetic packing material, such as polyvinyl chloride can lead to corrosion due to hydrogen chloride formation. The flue gases of the average incinerator contain 0.1 to 0.2% HCl. Corrosion can be prevented by neutralizing the flue gas, using excess air, and limiting superheater temperature. In coming years, the PVC fraction among refuse will increase to about 2% by weight. With the measures outlined, corrosion can be held within limits. If the polyvinyl chloride fraction, however, exceeds 5%, the danger of corrosion will be real.

7266 APTIC NUMBER 16280

Steading, T. W.
A STUDY OF THE EFFECTS OF AIR POLLUTANTS ON COMPUTERS. Preprint, California Dept. of Public Health, Berkeley, Air and Industrial Hygiene Lab., Dec. 21, 1963. 8p. (Presented at the Conference on Methods in Air Pollution Studies, 6th, Berkeley, Calif., Jan. 6-7, 1968.)

Information was collected on the dust content of indoor office environments where computers are used or could be used to establish design criteria for a dust testing chamber. Computer installations were investigated and their total dust loadings and particle size distributions were determined. Indoor gravimetric readings ranged from 77 to 578 micrograms per cu m, with the most frequent readings between 300 and 350 micrograms per cu m. However, a comparison of the data with that obtained in other, longer sampling periods, suggests that 1000 micrograms per cu m are not unusual in offices. Indoor dust levels had no relationship to outdoor dust levels, and air-condition offices showed the same dust levels as non-air-conditioned offices. The dust chamber is large enough to hold a small computer. Its feeder is a turntable powered by a synchronous motor on a variable radius to give a continuously variable speed drive. In testing dust, the dust is loaded into a tube, then fed into a depression in the turntable disk. As the disk rotates, the dust is carried to an aspirator which discharges partially mixed dust into the recirculating air stream. Mixing is completed as dust is carried through the duct and into the test chamber. The results of various dust tests are tabulated, and problems of maintaining constant dust loading are reviewed. Initial work on studying the effect of gaseous pollutants on computers is summarized.

7267 APTIC NUMBER 16009

Teege, Gerhot
ELECTROSTATIC CHARGING AS A CAUSE OF DUST DEPOSITION ON PLASTIC SURFACES-WAYS AND MEANS OF ITS PREVENTION. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):73-78, Nov. 1968. 15 refs.
CFSTI: TT 68-50488/11

Electrostatic charging, which causes dust to accumulate at vertical surfaces and even at inside and underside surfaces of plastics, originates in the electric double layer formed at the contact point between solid bodies of different composition. In the case of substances with high conductivities, the electric layer immediately collapses due to charge equalization when the surfaces are separated. Plastics have low conductivities and the charges cannot drain off; charge equalizatio is no longer possible. Electrical conductivity can now be determined either by direct measurements of the charge quantities or, preferably, by measurements of the electrical field strength. Charging can be reduced by rendering an entire plastic mass conductive or by increasing only surface conductivity. The first method is less satisfactory because it requires the use of additives, such as carbon black, in quantities sufficient to change other properties of the material. To increase surface conductivities, coatings of compounds with hydrophilic or ionic groups are applied to the surface of finished plastic parts, or antistatic substances are embedded in the plastic mass. The internal treatment is more effective, since surface layers are easily removed by washing and wiping.

7268 APTIC NUMBER 15884

Thomas, Gary E. and Robert M. Culbert
INGESTED DUST, FILTERS, AND DIESEL ENGINE RING WEAR. Preprint, Society of Automotive Engineers, Inc., New York, 6p., 1968. 3 refs. (Presented at the West Coast Meeting, Society of Automotive Engineers, San Francisco, Calif., Aug. 12-15, 1968, Paper 680536.)

Radioactive tracer techniques were used to measure piston ring wear caused by dust metered to the intake, air, fuel supply, and crankcase lubricant of an industrial diesel engine. Several basic air cleaner configurations were evaluated for their effectiveness in reducing ring wear due to ingested dust. These evaluations prove the superiority of paper type filters over oil baths in suppressing piston ring and linear wear. High wear rates were experienced during operations without an air cleaner or when an air cleaner was improperly maintained. Even a very small amount amount of dust or other abrasive contaminant introduced into an engine inlet system by careless handling or damage to the cleaner can nullify the benefits of the finest filtration equipment. Piston rings were especially sensitive to abrasive particles in the fuel. Sensitivity to a similar level of contamination in the crankcase lubricant was only 1/5 as great.

7269 APTIC NUMBER 16122

CUT POLLUTION AT WHAT PRICE? Elec. World, 173(3):32-33, Jan. 19, 1970.

Cost penalties for several methods available to reduce pollutants from power plants were discussed. The elimination of thermal pollution probably will have the greatest effect on the cost of power generation. A fossil-fueled power plant rejects about 30% less heat than a comparably sized nuclear-fueled plant. For fossil-fueled plants, the additional cost of mechanical-draft cooling towers over once-through systems is about $5-8/kw of capacity, while for hyperbolic cooling towers, it is about $10-15/kw (1970). The cost of cooling ponds vary appreciably, depending on the site location and soil conditions. In areas where there is little water seepage, cooling ponds can be built for $3-5/kw and where the pond must be lined, the cost is raised to $6-10/kw. For sea-water, wet-type cooling towers and ponds are not feasible. The use of dry towers eliminates the thermal pollution of surrounding waters and gives additional flexibility in site location. Cost studies of dry towers for a 1000-Mw nuclear-fueled unit show that mechanical draft designs would cost from $15-20/kw of electrical output, while hyperbolic designs would range from $25-50/kw. Mechanical and electrostatic precipitators are available with collection efficiencies of 98% for the cleaning of stacks of dust and sulfur oxide emissions. Scrubbing processes can effectively remove 90% of the sulfur oxides from stack gases at a cost of $10/kw. It was concluded that a significant reduction thermal discharge will increase power generation costs about 15% for cooling ponds and 30% for dry towers. These cost increases could have a significant effect on the prices of electricity and other products.

7270 APTIC NUMBER 16174

COSTS AND ECONOMIC IMPACTS OF AIR POLLUTION CONTROL FISCAL YEARS 1970-1974. Ernst and Ernst, Washington, D. C. Contract PH 22-68-29, Task Order 2, 321p., Oct. 1969. 26 refs.

A study was conducted to estimate prospective additional costs to the private sector of the economy of controlling air pollution from both stationary and mobile sources during the years 1970-1974. The pollutants considered are particulate and sulfur oxides from stationary sources and hydrocarbons and carbon monoxide from automobiles. Estimates of control conditions prevailing prior to the passage of the Air Quality Act (1967) were taken as a base. Two types of stationary sources are considered: combustion and process. Costs are estimated for controlling three classes of combustion sources: steam-electric power generation industrial fuel combustion, commercial fuel combustion. Industries for which process emission control costs are developed are sulfate pulping, sulfuric acid manufacture, petroleum refining, asphalt batching, hydraulic cement production, steel production, ferrous casting, and nonferrous metals smelting and refining. Only automobiles are included in the mobile source class. Estimates of additional costs to the private sector are developed for nationwide control of sulfur oxides and particulates from stationary combustion sources; nationwide control of particulate from process sources in eight selected industries and of sulfur oxides from sulfuric acid and petroleum refining process; nationwide control of automobile exhaust emissions; and combined control of sulfur oxides and particulates from combustion and process sources in 85 geographical areas. Estimated costs are presented as ranges within which actual costs can be expected to fall. The economic implications of control costs for the nation are discussed. The additional costs range from $0.9 to $1.7 billion dollars for 1970 and rise to $1.0 to $1.9 billion in 1974. (Author summary modified)

7271 APTIC NUMBER 16489

Federal Power Commission, Washington, D. C., Bureau of Power STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES, NINETEENTH ANNUAL SUPPLEMENT - 1966. Federal Power Commission Publ. S-185, 173p., Oct. 1967. 60 refs.

This supplement is the latest addition to the continuous comprehensive record of the operations of important steam-electric plants for the 29-year period 1938-1966. Plant investment costs and the 1966 annual production expenses of 531 plants in the United States and Puerto Rico are detailed in data sheets. Five of the plants are nuclear fueled; 519, fossil fueled. For the first time rural electric cooperatives are reported. The 519 fossil-fueled plants account for 89% of the continental United States' steam-electric generating capacity of 198,341 megawatts and for 95% of the total net generation in 1966. The scheduled capacity of fossil-fueled plants under construction or expansion is 86,000 megawatts in 268 units; that of nuclear-fueled plants on order, 42,000 megawatts in 56 units. Selected references are provided to descriptive articles and papers pertaining to several of the reported plants. Plants are indexed both alphabetically by name and alphabetically by state.

7272 APTIC NUMBER 16492

Federal Power Commission, Washington, D. C., Bureau of Power STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES. TWENTIETH ANNUAL SUPPLEMENT - 1967. Federal Power Commission Publ. S-192, 171p., Nov. 1968. 49 refs.

Data for 537 conventional fossil-fueled steam-electric plants in the contiguous U. S., Hawaii, and Puerto Rico, as well as for seven small, experimental nuclear-fueled plants are reported, accounting for over 95% of the total net generation in 1967. In general, the construction costs per kilowatt of capacity for fossil-fueled plants placed in service during 1967 were higher than for those initiated the previous year. The 1967 annual production expenses, including fuel, increased 0.31 mill per kilowatt-hour over 1966, or 9%. In each of the preceding nine years, these costs had decreased over the previous year. The 9% increase is attributed primarily to increased fuel costs. The 1967 national average heat rate for fossil-fueled steam-electric plants was 10,432 Btu per net kilowatt-hour. About 50% of the expenditures currently being made for the various research and development programs by the electric utilities and their trade associations is going into the nuclear power



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field, with major emphasis on fast-breeder reactor plants. By the end of July 1968, the total nuclear generating capacity scheduled for service during the period 1968 to 1976, totaled about 60,000 megawatts in 76 plant units. Air pollution, the thermal effects on sources of cooling water supply, and physical appearance of system facilities continued to emerge as major social-economic issues affecting the electric power industry. Technology for removing particulate emissions from powerplants is available; however, the demand for very high efficiency (99% plus) electrostatic precipitators is growing rapidly. Commercial devices for removal of sulfur oxides from flue gases are not yet available.

7273 APTIC NUMBER 16417

Francis, A. W. and Judson D. Lowd
HOW TO INCREASE LIQUID RECOVERY FROM YOUR GAS-CONDENSTATE OIL WELLS. Gas J., 57(51):68-75, Dec. 14, 1959.

High-efficiency liquid recovery methods, economically justified, are used on wet gas streams. Evaluation of the wellhead or lease-type processes covers: stage separation, liquid processing (stabilization), adsorption recovery from high-pressure separator gas, or combinations of these. Three divergent but typical gas-distillate well streams classified as lean, rich, and very rich are considered. The factors evaluated for each process on each stream are: liquid recovery efficiency, optimum separation conditions, gross operating incomes generated by increased recovery efficiency, differential expenses associated with increased recovery efficiency, the pattern for payback of increased investment, and the rate of return on the increased investment.

7274 APTIC NUMBER 16457

Julson, J. O.
ENVIRONMENTAL PROTECTION - HOW MUCH WILL IT COST YOUR MILL? Pulp Paper, 43(4):152-153, April 1969.

The cost of protecting the quality of the air against kraft mill odors, bleach plant gaseous emissions, particulates, soot, cinders, incineration of mill refuse, and water protection was discussed. Digester blow and relief gases are readily collected and can be thermally oxidized in a special furnace, lime kiln, or recovery furnace. Odor reduction was impressive and estimated capital cost was $125,000-$150,000 (1969). Turpentine should be condensed out of digester relief gases to take advantage of income generated through its sale. Black liquor oxidation is also effective in odor reduction and saves in chemical costs. Cost estimates ranged from $165,000 for a 200-ton mill to $240,000 for a 1000-ton mill. Particulate emission standards of 0.10 grains/standard cu ft of stack gas were obtained with precipitators. Capital costs for 99% efficiency ranged from $375,000 for a 200-ton mill to $1,087,000 for a 1000-ton mill. Costs for cyclone scrubbers and lime kiln scrubbers were considerably less. Capital costs for the trapping of chlorine and chlorine dioxide emissions by scrubbing in a caustic solution and returning the resulting solution back to the bleaching process ranged from $35,000 for a 200-ton mill to $155,000 for a 1000-ton mill. The installation of precipitators for soot and cinder control was estimated to cost $1.50/cu ft/min for 99% efficiency. The cost estimates of incineration of mill refuse ranged from $3400 for 50 lb/hr to $38,200 for 2000 lbs/hr. The costs of primary treatment, secondary treatment, and sludge incineration for water protection were also estimated. Capital and operating budgets will have to provide for these heavy added costs.

7275 APTIC NUMBER 16103

Kim, J. C. and M. C. Molstad
FIGURE OPTIMUM ABSORPTION DESIGN. Hydrocarbon Process., 45(12):107-108, Dec. 1966. 7 refs.

The minium unit cost of recovering solute in absorption operations is obtained by proper selection of absorber height and operating conditions. The relationship of these optimum conditions can be determined graphically from computer-processed data. To use the method, it is necessary to evaluate the total cost of the stripping operation, expressed as $/lb-mole of vapor produced at the base of the stripper; hours of operation per year, ratio of actual to minimum reflux ratios in the stripping columns; slope of the equilibrium curve in the absorption column, molal gas velocity through absorber, expressed in lb-mole/(hr) (sq ft); and the annual cost of power and fixed charges per volume of absorption column, expressed in $/(cu ft) (yr). An example is solved showing the use of water to recover acetone vapor at minimum unit cost from an air stream.

7276 APTIC NUMBER 15510

Lemmon, A. W., Jr., B. L. Fletcher, R. E. Schuler, and H. E. Carlton
A COST-UTILIZATION MODEL FOR SO2-CONTROL PROCESSES APPLIED TO NEW, LARGE, POWER-GENERATION FACILITIES. (Summary Report.) Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Contract PH 86-68-88, 170p., Jan. 17, 1969. 45 refs.
CFSTI: PB 182317

A cost-utilization model is presented for estimating the incremental cost of controlling SO2 emissions from large fossil-fuel-burning electric power stations by sulfur or sulfuric acid recovery processes. Additional alternatives considered are remote siting, nuclear generation, and low sulfur-content fuels. The model is formulated as a group of algebraic expressions suitable for organizing input data for computer processing. The forms are accompanied by data permitting the selection and entry of the appropriate numerical value in the proper location on a form once a specific SO2 control method is selected. The sequence yields the cost of electricity for the specific process and the expected values of the sulfur removed. A form provided for summarizing the results allows easy comparison of the results obtained for different approaches to SO2 control for any given region in the U. S. Calculations indicate that costs for nuclear generation are competitive with those for fossil-fuel generation. With currently available cost information, costs for SO2 control processes providing for recovery of sulfur or sulfuric acid in new large, power-

generation facilities should not exceed 0.5 mills/kwhr. Costs would be slightly lower with a high-sulfur content fuel. Because of transmission costs, remote generation does not appear to be a viable alternative.

7277 APTIC NUMBER 13613

Morrison, Warren E.
SUMMARY ENERGY BALANCES FOR THE UNITED STATES. SELECTED YEARS 1947-62. Bureau of Mines, Washington, D. C., IC-8242, 1964. 3 refs.

The production, consumption, and the various forms of energy resources in the U.S. from 1947 to 1963 are discussed. The major sources of commercial energy are anthracite, bituminous coal and lignite, dry natural gas, petroleum, and hydro and electric power. During the 15-year span, the greatest contribution to energy growth came from petroleum and natural gas. Bituminous coal declined throughout the period, and in 1962 ranked third after petroleum and natural gas. The basic energy markets are household, commercial, industrial, transportation, and electric utilities. Electricity generation by utilities has the fastest growth rate, about 5% during 1947-62. Bituminous coal is the major fuel used at power plants. Demand for solid fuels at electric utilities increased at an annual rate of 5-1/2% and represents coal's only major growth market during the period. Petroleum, including natural gas liquids, accounted for 62% of the total raw material use of energy resources in 1962, dry natural gas accounted for 13% and solid fuels 5%. It is believed that these findings will be useful for analysis of the energy economy and for projecting or forecasting the country's future energy position.

7278 APTIC NUMBER 15949

Osaka City Government, Dept. of Enterprise
ESTIMATION OF ECONOMIC LOSS CAUSED BY AIR POLLUTION IN OSAKA CITY (PUBLIC SECTION). (Kogai ni yoru keigai higai tyosa kekka (Kokyo bumon). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(2):81-91, 1969.

The cost of air pollution in Osaka City is considered in terms of the deterioration of private and public buildings and of budget allotments and research costs for pollution abatement programs. In 1967, an estimated $44,925,058 was spent on repainting and repairing buildings damaged by pollutants. Of this amount, $537,183 was spent by the public sector, $36,085,000 by private citizens, and $8,302,827 by business and industry. Of the $7,624,233 invested in pollution control programs, the government spent only $201,300. Although 17% of the private enterprise sector feels a responsibility for pollution problems, only 7.2% of this sector invested in abatement programs. The increased economic losses due to pollution are the result of the increased use of coal, heavy oil, and kerosine.

7279 APTIC NUMBER 16471

Smith, Ernest I.
LIQUEFIED NATURAL GAS AND ITS ROLE IN THE PETROLEUM AND CHEMICAL INDUSTRIES. Preprint, Texas Eastern Transmission Corp., Shreveport, La., 21p., Sept. 1968. 13 refs. (Presented at IEEE (Inst. Elec. Electron. Engrs.) Annual Petroleum and Chemical Industry Technical Conference, 15th, Dallas, Texas, Sept. 9-11, 1968, Paper PCI-68-46.)

The historical background of liquefied natural gas (LNG) is reviewed, and the contribution of the natural gas industry in the development of large-volume storage containers discussed. The potential economic advantage for new chemical plants to locate nearer large marketing areas is advanced on the basis that it is more economical to transport natural gas than it is to transport natural gas products such as alcohols, fertilizers, carpets, and clothes. The standby service made possible through recent LNG storage developments makes the reevaluation of new plant locations necessary. LNG will contribute substantially to solving air-pollution control problems while making it possible to maintain the benefits of industrialization. It is reported that natural gas is now fueling automobiles in California at the same cost as gasoline, and with much less smog. With only simple engine modifications, automobiles can be converted to operate on LNG. Emission of air pollutants from LNG-powered vehicles is less than half the volume from gasoline-powered cars. Also, LNG vehicle maintenance costs are less than maintenance costs for conventional fuel. Industry-wide, natural gas is recognized as the most ideal pollution-free fuel in use today. If it were not for the annual consumption of over 17 trillion cu ft of gas used in the United States, over 13 million additional tons of sulfur---oxide would be emitted by energy sources.

7280 APTIC NUMBER 16702

SPENDING FOR CLEAN AIR TO CLIMB. Steel, 164(5):38-39, Feb. 3, 1969.

Continued concentration of population in urban areas, increasing industrial production, and stricter emission laws will bring about an increase in spending for air pollution control equipment from $300 million last year to $800 million by 1977. The predicted spending for control of particulate and gaseous emissions by seven major industries is presented.

7281 APTIC NUMBER 16264

Wilson, Richard D. and David W. Minnotte
ECONOMIC ASPECTS OF AIR POLLUTION. Preprint, Public Health Service, Arlington, Va., National Air Pollution Control Administration. 24p., June 1969. 6 refs.

Economic analysis plays an important role in determing the impact of various air quality standards on a community by quantifying

as many factors as possible in the common denominator of dollars and cents. At the core of any economic analysis of air pollution control is the ability to define the best level at which to set an air quality standard. This is done in theory by defining two broad categories of costs: the costs of control, and the costs of pollution. If costs could be estimated for each different level of air quality, they could be represented as curves of control costs vs damage costs. The goal is to determine the least-cost combination of the costs of control and pollution that will occur when the sum of these two cost curves is at a minimum. However, no control cost curve can be drawn in this manner, since no one level of air quality exists through an air quality region. Moreover, each regulatory scheme has its own associated costs. These problems are discussed in detail, and a method of economic analysis for a region is proposed that combines economic damages associated with pollution with control costs and benefits. In sample surveys, the benefits from air pollution control are found to outweigh substantially the costs of controlling pollution.

7282 APTIC NUMBER 15715

COMMUNITY AIR QUALITY GUIDES. ETHYLENE. Am. Ind. Hyg. Assoc. J., 29(6):627-631, Nov. - Dec. 1968. 24 refs.

The multi-disciplinary backgrounds and professional competencies within the American Industrial Hygiene Association have been utilized to the fullest in the preparation of a series of ambient air quality guides. These are intended to be concise. To be concise they are offered as single compounds, recognizing that other factors such as potentiation, antagonism, or other effects associated with mixtures, will create special problems from place to place and from time to time, the effects of which must be individually evaluated. These guides are based on present scientific knowledge; as new data becomes available, the recommended threshold values are subject to change. The literature relating to the subject matter of each of the ambient air quality guide series is constantly being reviewed, and when indicated, new guides are prepared. (Author's Abstract)

7283 APTIC NUMBER 16518

California State Dept. of Public Health, Berkeley, Bureau of Air Sanitation
NEW AND REVISED MOTOR VEHICLE STANDARDS ADOPTED. Clean Air Quart., 8(4):1-27, Dec. 1968.

California's 1970 emission standards for motor vehicles reduce hydrocarbon exhaust levels from 275 to 180 ppm by volume and carbon monoxide exhaust levels from 1.5 to 1.0 percent by volume. The crankcase hydrocarbon standard is lowered from 0.15 to 1.10 percent of the supplied fuel. For the first time the following standards are included for fuel tank and carburetor hot soak emissions respectively: 6 g/day; and 2 g/day. Approximately 95% of hydrocarbon losses are now covered by emission standards. However, further improvements in the standard are anticipated. It is hoped that the hydrocarbon standards can be eventually stated in terms of the reactive compounds producing photochemical smog. Also under consideration is a standard for nitrogen oxides. As the result of a prolonged smog attack in September and October 1966, three Southern California cities experienced more than 20 'adverse' days when the total oxidant exceeded 0.15 for one hour or longer. Unless emissions of pollutants, particularly those from automobiles, are curbed, further severe smog episodes will occur. The State Motor Vehicle Pollution Control Board has given its approval to the Chrysler exhaust control system. Current studies of carbon dioxide contamination from engine compartments show CO concentrations in closed cars of 100 to 200 ppm. Although exposure to these levels for two hours or longer could adversely affect a commuter's carboxyhemoglobin level, the CO levels are not likely to be influenced by controlling hydrocarbon and carbon monoxide emissions with afterburners. Levels of oxidants, nitrogen oxides, carbon monoxide, and sulfur dioxides recorded by state monitoring stations are tabulated.

7284 APTIC NUMBER 16635

Gil'denskjol'd, R. S.
EXPERIMENTAL BASIS FOR THE DETERMINATION OF MAXIMAL ALLOWABLE SINGLE CARBON BISULFIDE CONCENTRATION IN ATMOSPHERIC AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol.8:153-158, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Atmospheric air pollution with carbon disulfide discharged from a combine was studied. Air samples were collected within radii of 150, 500, 1000, 1500, 2000, 2500, and 3000 m from the combine. A total of 342 samples were collected on the lee side of the plant. Results showed that carbon disulfide vapor was detected 3000 m from the plant. Carbon disulfide odor was detected 2000 m from the plant. Sensory tests indicated that 0.05 mg/cu m of carbon disulfide was the threshold concentration sensed by most odor-sensitive persons. Optical chronary tests indicated that 0.04 mg/cu m of CS2 was the threshold concentration of carbon disulfide reflex activity affect. Statistical analysis showed that 0.04 mg/cu m CS2 was the minimal active concentration which elicited shifts in darkness adapted eye sensitivity to light, and that 0.03 mg/cu m was the maximum subthreshold concentration. It was concluded that the existing 0.5 mg/cu m maximal single and 0.15 mg/cu m average 24-hr CS2 concentrations were too high. The presently recommended and adopted 0.03 mg/cu m limit of allowable carbon disulfide concentration in atmospheric air of inhabited localities is below the threshold of odor perception and reflex activity affect.

7285 APTIC NUMBER 16019

VDI (Verein Deutscher Ingenieure) Fachgruppe Staubtechnik, Duesseldorf, Germany
PERFORMANCE MEASUREMENTS AT DUST COLLECTORS. VDI (Ver. Deut. Ingr.) Richtlinien, no. 2066, 27p., May 1966. 38 refs. Translated from German by M. Schneider, Israel Program for Scientific Translations, Jerusalem.
CFSTI: TT 68-50469/3

The 3rd edition of the VDI Directive 'Performance Tests at Dust Collectors' deals only with performance measurements required to evaluate dust collectors. Chapters on measuring techniques are essentially identical with those in the 1936 and 1949 editions. Standardized methods and rules are presented for analyzing gas composition, including moisture, temperature, and pressure; the gas stream; the dust content of the main stream; the mass of separated dust; the fineness and material composition of dust; collection efficiency; and collector consumption of energy and of working media, such as water and oil. The Directive is enlarged by chapters dealing with the design and operation of the most widely used dust measuring instruments and measurement errors most likely to occur. Calculation methods are illustrated by appropriate formulae.

7286 APTIC NUMBER 15890

Joosting, P. E.
EVALUATION OF TOLERABLE LIMITS OF SULFUR DIOXIDE CONCENTRATION AT THE SITE BASED ON AVAILABLE DATA. (Evaluation des limites tolerables de concentration en SO2 sur le terrain a partir des donnees disponibles). Text in French. Pollut. Atmos. (Paris), 11(Special):41-52, Feb. 1969. 4 refs.

The purpose of this review is to show how meaningful criteria for air quality can be established by assembling statistics acquired in the Netherlands and elsewhere, first in the area of the techniques of measuring sulfur dioxide pollution, then in the area of the effects of this pollutant on vegetation and the human being. Sulfur dioxide was picked as a typical pollutant. Important factors to be considered are the duration of measurement of samples of polluted air, since concentrations of pollutant can vary rapidly with time. Twenty-four hours was the duration chosen. Figures for duration of sampling are plotted against concentration in cities in the Netherlands and the U. S. From these data plots are constructed of variation of observations versus concentration. A phenomenological norm is then theoretically formulated. Effects of pollution noted in various cities during certain periods are plotted against sulfur dioxide concentration; finally, figures from the U. S. Public Health Service on effects of sulfur-dioxide pollution on health are reproduced.

7287 APTIC NUMBER 15929

CRITERIA, INSTRUMENTATION, AND MONITORING: APPENDIX 2 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 64-254, 1966.

Wastes are presently disposed of primarily through discharge in natural waters, to the atmosphere, and by deposit on or below the surface of the gound. Although steps have been taken to regulate excessive pollution of all natural resource reservoirs, the magnitude of the problem requires the formulation of a national policy on resources and waste management together with the selection of criteria on which to base pollution-control programs. Human health is perhaps the most important criterion since a real potential for widespread catastrophe exists in many areas. In danger areas, work to ensure prevention of catastrophes must be undertaken immediately. Similarly, intensive cleanup and control programs must be undertaken in ares where water and land are running close to their pollution capacity. Unfortunately, there is often no way by which various pollution problems can be solved individually. In solving a water-pollution problem, for example, a land-pollution problem may be created. In all these instances, cycling and recycling make it impossible to sort out one kind of pollution from another. Consideration must be given to the development of methods permitting total recycling of all materials consumed and subsequently discharged. The development of this technology cannot be considered as a long-term goal. As indicated by climatic changes, destruction of water supplies, and deterioration of land, the need to maintain a large proportion of the earth in a relatively natural state is imperative.

7288 APTIC NUMBER 16514

National Air Pollution Control Administration, Raleigh, N. C., Div. of Abatement
INTERIM GUIDE OF GOOD PRACTICE FOR INCINERATION AT FEDERAL FACILITIES. NAPCA Pub. AP-46, 94p., Nov. 1969. 19 refs.

This guide is to be used by Federal Agencies in selecting incinerators for burning the following wastes: highly combustible mixtures, e.g., paper, cardboard, wood, floor sweepings, plastic, and rubber, containing 10% moisture and 5% noncombustible solids; combustible mixtures of paper, cardboard, wood, foliage, floor sweepings, and restaurant wastes containing 25% moisture and 10% noncombustible solids; approximately even mixtures of rubbish and garbage containing up to 50% moisture and 7% incombustible solids; and human and animal remains containing up to 85% moisture and 5% incombustible solids. The information presented applies to incinerators with a burning capacity of 2000 pounds/hr or less of general refuse and up to 200 pounds/hr of pathological wastes. Multiple-chamber retort or multiple-chamber in-line incinerators are specified for general refuse; multiple chamber retort incinerators, for pathological refuse. Any incinerator of more than 200 pounds/hr capacity must be equipped with specified scrubbers or scrubbers of equivalent efficiency. Testing will not be required for incinerators and incinerator-scrubber combinations built as recommended. Multiple-chamber incinerators conforming to Incinerator Institute of America Standards will be accepted as alternate incinerators if their emission levels are determined by prescribed tests.

7289 APTIC NUMBER 15716

NEW RECOMMENDS TOUGH SULFUR RULES. Oil Gas J., 67(7):58-59, Feb. 17, 1969.

Issuance of air quality criteria for sulfur oxides sets the stage for a new clean air drive by the federal government. The proposed criteria for sulfur oxide would require a sulfur ceiling of 1% in fuels. The recommendations are based on the assumption that sulfur oxides of 0.1 ppm or more in the atmosphere over a period of 24 hrs. may be dangerous to the health.

7290 APTIC NUMBER 16586

Schafer, Howard C.
A WORKABLE METHOD FOR DETERMINING ENVIRONMENTAL CRITERIA. Inst. Environ. Sciences, Inst. Environ. Sci. Annu. Tech. Meet. 14th, St. Louis, Mo., 1968, p. 361-366. (April 29-May 1).

The problem of establishing environmental criteria for the design and qualification of air-launched ordnance is discussed. Though the Department of Defense specifies climatological extremes as a

mandatory criterion for military equipment, the actual extremes that ordnance will experience must be determined. It is the function of the environmentalist to place the two sets of criteria in proper context. Any climatological extreme may well be the limiting situation. In cold climates, the ambient air temperature is the major thermodynamic driving force, and the energy level of the driven item should not be less than that of the driving force. In the desert or the tropics, the ambient air temperature is a secondary thermodynamic force, the primary driving force being the direct radiation from the sun. In the future, environmental testing must be based on the determination of the driving forces to which the unit will be exposed. There must also be a method to determine what the use of air-launched ordnance should be: a stockpile-to-target sequence is suggested. In this way, the criteria and test specifications can make use of the statistical distributions of criterion instead of combining extreme situations.

7291 APTIC NUMBER 13527

Thomas, Moyer D.
REACTIVITIES OF SMOG COMPONENTS ARE CENTRAL ISSUE IN SETTING CONTROL STANDARDS. Environ. Sci. Technol., 3(7):629-633, July 1969. (Presented at the 156th national ACS meeting, Atlantic City, N. J., 1969.)

Photochemical smog contains nitrogen oxides, ozone, ozonated olefins and other organic compounds. Nitrogen oxides react with organic compounds to form noxious gases which are injurious to vegetation and are strong eye irritants. Maximum concentrations of nitric oxide and nitrogen dioxide occur during peak traffic hours. Ozone is phytotoxic, causing upper surface necrosis, stippling, and mottling. Human respiratory functions are adversely affected by 0.3 to 0.5 ppm ozone. Peroxyacyl compounds are said to be 200 times more irritating than formaldehyde and it also affects plants. Some of the polynuclear hydrocarbons are carcinogenic. Concentrations of remedial measures are presented. Discussion by D. E. Wimmer: Unlike air pollutants which originate from imperfections in the combustion process, nitric oxide is a basic and necessary product of efficient power production in internal combustion engines. It is uncertain whether reducing nitric oxide concentrations would reduce photochemical smog. The benefits are rather nebulous and costs are very concrete. Reaction rates, in addition to emission levels, should be considered in formulating regulations. Discussion by A. P. Altshuller: Most nitrogen oxides present in automobile and stationary sources are in the form of nitric oxide, indicating that nitrogen dioxide is due to photochemical oxidation. The bulk of experimental data indicates that all photochemical air pollutants except nitrogen dioxide are much reduced by hydrocarbon control. Cost vs benefits should be considered in establishing controls.

7292 APTIC NUMBER 15811

Ward, J. W. and H. W. Habgood
THE INFRARED SPECTRA OF CARBON DIOXIDE ADSORBED ON ZEOLITE X. J. Phys. Chem., 70(4):1178-1182, April 1966. 9 refs.

Absorption bands of carbon dioxide on various cationic forms of zeolite X were obtained between 2200 and 2500 reciprocal cm and below 2000 reciprocal cm. Spectra of carbon dioxide adsorbed on the Ca, Sr, and Ba forms showed no evidence of bent or carbonate-like structures such as reported for carbon dioxide adsorbed on LiX, NaX, and KX. This difference is believed to be due to the absence, in zeolites containing divalent cations, of any cations in the highly exposed type-III sites. Carbon dioxide on HgX showed some carbonate-like bands in the 1300-1750 reciprocal cm region, but apparently only partial replacement of monovalent cations was achieved. The spectra of carbon dioxide on both group I-A and group II-A zolites showed a strong band between 2350 and 2375 reciprocal cm, the stronger the electrical field of the cation the higher the frequency. This band was accompanied (in most cases) by two pairs of weaker side bands symmetrically spaced about the central band. It is concluded that the band observed at high pressures at or slightly below 2350 reciprocal cm is due to the physical absorption of carbon dioxide; the bands in the 1300 to 1750 reciprocal cm region with LiX, NaX, and KX to chemisorption; and the band at low pressures between 2350 and 2375 reciprocal cm to adsorption by an ion-dipole interaction.

7293 APTIC NUMBER 14457

Yamate, Noboru
ESTABLISHMENT OF ENVIRONMENTAL STANDARDS FOR PREVENTION OF AIR POLLUTION DUE TO SULFUR OXIDES. (Io-sankabutsu ni yoru taikiosen boshi no tame no kankyo kijun no settei ni tsuite Toshin.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6(3):60-62, Aug. 1968.

The Environmental Improving Committee reported the Environmental Standard for prevention of air pollution due to sulfur oxides according to the request of the Minister of Health and Welfare. The primary objective of the establishment of this standard was to protect human health. Based on this primary goal, an attempt was made to coordinate the maintenance of a safe environment with sound industrial development. The proposed standards are: 1) At least 99% of total hours through the year should show below 0.2 ppm/hr sulfur oxide emission 2) Annual average should not exceed 0.05 ppm/hr 3) At least 8-10 months of the year should show a daily average below 0.05 ppm/hr 4) The electrical conductivity method should be used to measure the concentration in order to standardize the results. It is recommended that the industries in highly polluted districts make every effort to meet this standard within 10 years; those in moderately polluted districts in 5 years; and those in newly developing districts immediately.

7294 APTIC NUMBER 16358

Zielhuis, R. L.
DETERMINATION OF ACCEPTABLE CONCENTRATIONS. (Het vastellen van aanvaardbare concentraties). Text in Dutch. Tijdschr. Soc. Geneesk., 47(2), Suppl. 2, 23p., Oct. 3, 1969. 80 refs.

Difficulties associated with determining atmospheric concentrations acceptable from biological and social viewpoints are discussed.

The decision of acceptable limits rests on three types of choices: qualitative, quantitative, and tolerance. The first of these is grouped into four categories: detectable changes in health occuring during a person's lifetime, rapidly reversible effects that do not cause a definite disease, reversible disease, and irreversible disease. A subdivision is suggested for certain working phenomena such as morphological changes, changes in functions during experiments, biochemical changes, and nuisances and odors. Differences between American and Russian approaches to acceptable limits are outlined. The Russian view considers unacceptable any deviation from normal, does not give attention to practical difficulties, uses a standardized guideline and is dogmatic. The American view assumes the importance of deviations from the normal, favors weighted averages, and is practical and pragmatic. Most other nations base their allowable concentration values on either the Russian or American criteria. There is still no international agreement on al acceptable values. The author discusses different types of acceptable limits such as emergency exposure limits, emergency tolerance limits, ceiling values, and maximum allowable concentrations. The use and misuse of terms is also considered.

7295 APTIC NUMBER 16104

Zielhuis, R. L.
PERMISSIBLE LIMITS FOR INORGANIC LEAD IN INDUSTRY. T. Soc. Geneesk., 47(22-31):743-748, Oct. 1969. 12 refs. (Presented at the 11th Congress of Occupational Hygiene, Ustinad Labem, Czechoslovakia, June 1969 and the 16th International Congress of Occupational Health, Tokyo, Japan, Sept. 1969.)

At a conference held in The Netherlands, November 28-29, 1968, permissible limits were established for inorganic lead by the Subcommittee on MAC Values in Industry of the Permanent Commission of the International Association of Occupational Health. Some conclusions of this conference are discussed: the relationship between concentration in air and biochemical parameters; permissible limits for concentration in air and for biochemical parameters; and the possibility of chronic sequelae. Permissible limits of lead in the blood (PbB) are 70 micrograms/100 ml. Permissible limits for concentration in air are 150 micrograms/cu m for a 40 hr wk. Other limits are PbU, 130 micrograms/l; ALA, 10 micrograms/l; and CPU, 300 micrograms/l. The conference concluded that lead poisoning affects physical, mental, or social wellbeing. The possible responses to lead are classified as acceptable, excessive, or dangerous. In an acceptable response, absorption is below permissible limits when poisoning does not occur. In an excessive response, absorption is above permissible limits where poisoning may occur. Absorption in a dangerous response is above permissible limits where poisoning is likely to occur or already exists. It is suggested that standards preventing the occurrence of episodes among workers will prevent long-term sequelae even after many years of continual exposure.

7296 APTIC NUMBER 16504

Brocke, W.
MEASURES ADOPTED IN WEST GERMANY FOR COMBATING THE EMISSION OF SO2 INTO THE ATMOSPHERE. (Misure per combattere l'immissione dell' SO2 nell'atmosfera adottate nella Germania Occidentale). Text in Italian. Riv. Combust., 22(7/8):397-401, July-Aug. 1969. (Presented at the 'Le grandi Centrali Termoelettriche e nucleari ed i problemi dell'inquinamento atmosferico, Tavola Rotonda, Rome, April 4, 1968.)

Sources of atmospheric sulfur dioxide pollution in West Germany are distributed as follows: thermoelectric plants, 35%; industrial installations, 47%; and domestic uses, 18%. In North Rhine-Westphalia, the SO2 level is measured every 14 days at 5000 check points, over an area of 5000 square kilometers. This province, which produces 50% of Germany's electricity, 80% of its iron and steel, and 50% of its chemicals, has a smog warning system based on 12 special measuring points. At 2.5 mg/cu m, a preliminary alert is given, while at 5 mg/cu m of SO2, the authorities are to inform industries to switch to low-sulfur fuels, and motor traffic is to be restricted from 6-10 a.m. and 4-8 p.m. This provincial government has spent more than 6 million DM (about 1.5 million dollars) on studying desulfurizing procedures. Experimental projects include: the Reinluft process; lime/dolomite absorption; 'airborne ash-lignite'; activated carbon; the Siemens process (using iron oxides); the Grillo process (using special metallic oxides); the Sulfacid process; and experiments with wet processes, with special attention to methods of regenerating the washing solution. Desulfurizing the fumes from an electric plant increases the cost of each kilowatt hour by an estimated 4-10%. Certain by-products of the desulfurizing process are much in demand. No danger exists of saturating the market with sulfuric acid, ammonium sulfate, gypsum, or calcium sulfite. If all the sulfur dioxide produced by German thermoelectric plants were made into sulfuric acid, it would fill only 60% of current demands for the acid.

7297 APTIC NUMBER 15985

Chael', V. L. and O. V. Kudinov
CONSERVATION OF AIR AND WATER BASINS IN THE GENERAL PLANS OF CITIES. (Okhrana vozdushnogo i vodnogo basseynov v general'nykh planakh gorodov). Text in Russian. In: Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov. Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p. 23-26.

The need for formal air quality control standards in city planning is pointed out. A hypothetical problem involving two industrial emission sources is discussed in general terms. Amendments to specifications SN 345-66 in particular are called for.

7298 APTIC NUMBER 16506

Federal Power Commission, Washington, D. C.
UNIFORM SYSTEM OF ACCOUNTS PRESCRIBED FOR PUBLIC UTILITIES AND LICENSEES (CLASS A AND CLASS B). FPC A-5, 166p., March 1965.

A uniform system of accounts for public utilities and licensees as prescribed under the Federal Power Act is given in its entirety. The system of accounts is applicable in principle to all Class A and Class B licensees subject to the Commission's accounting requirements. Various terms are defined. Instructions in regard to electric plants, operating expense, balance sheet, income, operating revenue, and operation and maintenance expense, are provided. Every licensee and every public utility must file an annual report which includes among other things full information as to assets and liabilities, capitalization, net investment, and reduction thereof, gross receipts, interest due and paid, depreciation and other reserves, cost of project and other facilities, cost of maintenance and operation of the project, cost of renewals and replacement of the project works and other facilities, depreciation, generation, transmission, distribution, delivery, use, and sale of electric energy.

7299 APTIC NUMBER 16537

Fujiwara, Masahiro
AIR POLLUTION CONTROL IN ALUMINIUM WORKS UNDER ALKALI AND WORKS REGULATION ACTS IN ENGLAND AND WALES. (Eikoku no arukariho ni motozuku arumiyumu kojo niyoru taikiosen boshi gyosei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(3):13-15, March 15, 1967.

Air-pollution control in England is based on the Alkali and Works Regulation Acts and the Clean Air Act. The country is divided into seven Alkali Inspectors' Districts administered by 25 inspectors who maintain close contact with local health and smoke inspectors. The annual reports compiled by the inspectors form the basis of the Manual Reports submitted to the Ministry of Housing and Local Government. These reports contain the air pollution plans and policies currently in practice. The contents of the Manual Report of 1960, 1964, and 1965 are summarized. Though England does not have a primary aluminum refining industry, it has aluminum manufacturing industries which mainly treat aluminum scraps. Air pollution problems due to aluminum manufacturing, and countermeasures, are discussed in the 1960 Manual Report. A number of plants found venturi scrubbers unsatisfactory for reducing smoke emissions. Better results were obtained by rinsing the aluminum scrap and discharging smoke from taller stacks. The 1964 Manual Report shows that the problem of an oily smoke was partly solved by afterburners and that of fumes solved by employing hearth furnaces (flat type) which do not require flux. The reports emphasize the cooperation between legal authorities and industry. This approach to practical control measures has implications for countries which are trying to control air pollution by legal means alone.

7300 APTIC NUMBER 16615

Harris, Robert L., Jr.
AIR POLLUTION CONTROL PROGRAM GRANTS. Preprint, Public Health

Service, Washington, D. C., National Air Pollution Control Administration, 16p., 1969. (Presented at the American Bar Association, National Institute Meeting Federal Urban Grants: Policies and Procedures, Washington, D. C., Oct. 3.)

The major program grant activity of the National Air Pollution Control Administration is outlined in Section 105 of the Clean Air Act. This section authorizes HEW to make grants to air pollution control agencies for planning, developing, establishing, or improving programs for the prevention and control of air pollution. Each of these grants has a special purpose. Planning grants are for assistance in developing air quality control programs. Development grants assist official agencies without legal authority in prevention or control of air pollution to develop initial control programs. Establishment project grants are made to put a workable air pollution control program into operation. Improvement grants are for projects to improve specific areas of on-going programs. Programs which have reached an acceptable degree of effectiveness are eligible for maintenance grants. The administration of all NAPCA program grants is guided by the 'Health Services Projects Grants Manual,' published by the Public Health Service. Section 196 of the Clean Air Act authorizes grants to interstate air quality control regions formally designated by HEW. To be eligible for such a grant, an agency must be designated by Governors of the affected states, and must be able to recommend air quality standards and plans for implementing a control program in the region. Only one such grant will be made in any air quality control region. Section 105 of the Clean Air Act provides for planning grants to intrastate regions or to interstate regions not formally designated by HEW. All other project and maintenance grants to air pollution control agencies are governed by formal regulations published on May 30, 1967 in the Federal Register. Revision of its priority system for program grants is under consideration by NAPCA.

7301 APTIC NUMBER 16343

CONTROL OF AIR POLLUTION. Intern. Digest Health Legislation, 20(3):499-512, 1969. (Original text in Public General Acts and Measures of 1968, Chapt. 62, p. 1523-1538, 1969.)

The British anti-air pollution act is presented in its entirety in addition to supplements, schedules, and means of administration. Various terms are defined. Limits on the rates of emission are prescribed. The uses of furnaces are standardized, and the over-all policy of the act is provided. The emissions covered include dark smoke, grit, dust, and fumes.

7302 APTIC NUMBER 15983

Kalyuzhnyy, D. N.
SANITATION OF ATMOSPHERIC AIR IN CITIES OF THE UKRAINIAN SSR. (Ozdorovleniye atmosfernogo vozdukha v gorodakh Ukhrainskoy SSR). Text in Russian. In: Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov. Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p. 14-15.

A brief historical review of efforts to establish air pollution control measures in the Ukraine since 1920 is presented. A total of 3021 control installations have been put in operation and gas conversion has been made on a total of 340 industrial and 1971 domestic sources. By 1965 it was recognized that research in control methods was inadequate and that a special group for designing control equipment was needed. The following measures are deemed necessary: prohibit the construction of new industrial enterprises until measures have been taken to eliminate pollution in residential areas of industrial regions; step up research; and establish special plants for producing the required control equipment.

7303 APTIC NUMBER 16118

Knauer, Armin
KEEPING AIR CLEAN AND SOME ASPECTS OF OPTIMIZATION IN THE SOLUTION OF THIS PROBLEM. (Luftreinhaltung und einige Aspekte der Optimierung bei der Loesung dieser Problemstellung). Text in German. Z. Ges. Hyg. (Berlin), 15(11):807-811, Nov. 1969.

Using a simplified pattern, basic ways of air pollution control were outlined and some elementary demands were formulated. A solution to the problem of air pollution control is possible only if the detrimental effects on the environment per unit volume of production can be reduced faster than the volume of production increases. Because of economic consequences, an attempt must be made to find the optimum solution. One of its preconditions is a better knowledge of the quantitative relations. Partial problems can be solved by epidemiological studies. (Author summary modified)

7304 APTIC NUMBER 16069

Kramer, Harry P., Frank L. Cross, Jr., Charles L. Frank, and Roger W. Ross
NAPCA MANPOWER DEVELOPMENT PROGRAM USES SIMULATION EXERCISES TO TEACH REGIONAL AIR QUALITY MANAGEMENT COURSE. Preprint, Public Health Service, Durham, N.C., National Air Pollution Control Administration, 10p., 1969. 3 refs. (To be published in Environmental Science and Technology Magazine.)

The Institute of Air Pollution Training of the Office of Manpower Development, National Air Pollution Control Administration, is currently conducting courses involving control strategies that will be useful to control officials in Air Quality Control regions. To accomplish this, a series of workshops, seminars, role playing exercises, computer games, and simulation exercises are being held in strategic parts of the country. In a typical game, students are provided with a computer-prepared map of pollutant concentrations in a hypothetical community. They then develop a consensus on air quality standard for the community and control techniques that will produce an air quality that meets the standard. When a desired air quality goal has been agreed on, a new computer map is prepared so that students can compare the original community concentrations with the outcome of the strategies they have developed. Other games enable participants to simulate role-playing situations in a discussion of land use,

inventory emissions, and to determine minimum air monitoring needs. (Author abstract modified)

7305 APTIC NUMBER 16344

Miller, Leonard A. and Doyle J. Borchers
PRIVATE LAWSUIT PROJECTED IN AIR POLLUTION CONTROL. Environ. Control Management, 139(2):30-38, Feb. 1970.

Law, used as a tool for the control of newly appreciated hazards, often pursues a dual approach of private litigation and public legislation. The interaction of these two methods as they attempt to meet the emerging dangers of atmospheric pollution are evaluated. The private action is important in air pollution control, but it is not a substitute for governmental regulation. The legal elements of a lawsuit in air pollution-damage, careless conduct, and social value-which may be affected by the criteria and control techniques documents are explored. Air pollution problems have been divided into two distinct categories for legislative purposes. The first category, local air pollution, has been defined as 'air pollution in a specific area readily discernible as being caused by a single source or a group of sources in close proximity to each other.' The second is 'air pollution caused by air contaminants from a multiplicity of scattered sources which are influenced by common meteorological and topographical characteristics, and intermingled and distributed so that the sources of the air contaminants cannot be readily discerned.' Private action is not suited to the solution of area-wide air pollution problems. The modern tendency is to look to the injury which occurred, and if it is the type for which the law takes cognizance, to structure the case around whatever theory meets the facts.

7306 APTIC NUMBER 15935

LEGAL AND PUBLIC ADMINISTRATION. APPENDIX 6 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 203-221, 1966.

The increasing importance of institutional and organizational design for pollution control is examined and models of institutional design discussed. It is emphasized that institutional design is not a problem for which there is a ready solution. Like the making of a law, some of its elements are amenable to problem-solving and problems for which hard data provide answers. Other elements require devices to hedge against the unpredictable and to permit decisions to be made despite prohibitive information costs. Finally, institutional design must strike some bargain with existing institutions and vested rights. The job of institutional design is intelligently sorting out and ordering these elements, rather than pursuing one calculus for decisions or devising a system in which one instrument of control works but is unaided by others. Design approaches are engineers' and economists' regional and optimizing methods of analysis, the latter involving cost-benefit studies and system design; and a formalist model emphasizing the formal hierarchy of government and using legal and administrative tools. The proper design of air-pollution-control institutions requires a synthesis of these complementary methods. There must be a continuing reconciliation of the legal and economic tools of calculation and control and of the regional and formal-government methods of organization.

7307 APTIC NUMBER 15936

PUBLIC POLICY AND INSTITUTIONAL ARRANGEMENTS. APPENDIX 7 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 222-235, 1966.

New policies and institutional arrangements, and the extent to which they are supported, will determine the effectiveness of new technologies for controlling pollution. Because the effects of pollution are not borne by the polluting agency, which has no economic motive to eliminate them, public action is needed to protect society as a whole from these effects. Because polluting sources are unlikely to benefit from underwriting research on improvements in pollution control, the support of research is also a necessary function of public agencies. In fact, such an agency must be almost exclusively for research relating to the effects of pollution on health, the economy, the society, and the environment in general. Government is similarly looked to for the dissemination of information on the causes and effects of pollution, and on possible solutions. Laws and public policy will establish the environment that will determine the response of the private sector and individual public agencies to pollution problems. Because of the strategic role of government agencies in establishing this environment, their organization, staffing, financial support, and authority are critical to a successful attack on pollution.

7308 APTIC NUMBER 16073

Texas Air Control Board, Austin and Public Health Service, Durham, N. C., National Air Pollution Control Administration
REPORT FOR CONSULTATION ON THE METROPOLITAN DALLAS-FT. WORTH INTRASTATE AIR QUALITY CONTROL REGION (TEXAS). 29p., Oct. 1969. 7 refs.

A ten-county air quality control region proposed to abate air pollution in the metropolitan Dallas-Fort Worth area. The proposal is the result of two studies relevant to the problem of defining the boundaries of air quality control regions. The first was an evaluation of the area's topography, air pollutant emissions, meteorology, estimated air quality levels, and available air quality data; and second, a study of the location of population and industry, population density, projected growth of population and industry, and jurisdictional considerations. Emission densities were calculated from emission quantities and grid areas. Emissions and meteorological data were used in a diffusion model to estimate air quality levels. Although prevailing area winds promote dispersion, thermal inversions occur about 35% of the time. Dallas and seven other counties

are experiencing suspended particulate levels higher than background levels. While not an area-wide problem, sulfur oxides are present in Dallas and Tarrant, which are the major point sources of pollution. Portions of most counties are experiencing carbon monoxide pollution, the distribution of which correlates with major traffic patterns. Despite the low air pollution potential in several counties, it is logical to include them in the air quality control region, since they too administer the North Central Texas Council of Governments.

7309 APTIC NUMBER 16074

Texas Air Control Board, Austin and Public Health Service, Durham, N. C., National Air Pollution Control Administration
REPORT FOR CONSULTATION ON THE METROPOLITAN SAN ANTONIO INTRASTATE AIR QUALITY CONTROL REGION (TEXAS). 27p., Oct. 1969. 8 refs.

An initial proposal for a Texas intrastate air quality control region is based on two separate studies conducted in the San Antonio area: an evaluation of 'engineering factors' and an evaluation of 'urban factors.' The former indicates the location of pollution sources and the geographic extent of serious pollutant concentrations in the ambient air. The second reviews existing governmental jurisdictions, current air pollution control programs, present concentrations of population and industry, and expected patterns of urban growth. Because stagnating anticyclones are almost nonexistent in the area, prolonged air pollution concentrations do not occur. In addition, in the absence of high sulfur content fuelds and processes involving sulfur products, sulfur oxides are not an area-wide problem. Maximum SO2 emission density for the area is less than 0.07 tons/sq mile/day. The distribution of carbon monoxide correlates with major traffic problems. As determined by a diffusion model based on wind rose data and mixing depth information for an eight county area, the major point sources of sulfur dioxide, carbon monoxide, and particulates are Bexar, Comal, and Guadalupe counties. Since these counties have the highest projected growth rates during the next 15 to 30 years, it is proposed that they form the San Antonio Air Quality Control Region.

7310 APTIC NUMBER 16158

Reynolds, P.
A CRITICAL REVIEW OF CURRENT CLEAN AIR LEGISLATION. Roy. Soc. Health J. (London), 88(6):276-280, Nov.-Dec. 1969. 4 refs. (Presented as the Public Health Inspectors Session at the Health Congress, Eastbourne, April 30, 1969.)

In the United Kingdom, legislation to control air pollution is directed against the major problem of pollution by sulfur dioxide, smoke, dust, and grit with the object of reducing visible emissions. It does not consider light emissions which contribute significantly to background pollution nor the degree of control made possible by recent technological developments. Legislation should be enacted to prevent or minimize all emissions at the source and to enable emission standards to be prescribed. When prevention is impracticable, legislation should require pollutants to be discharged at a high level for dispersion. In addition, local authorities must be granted powers to deal with pollution as soon as possible.

7311 APTIC NUMBER 13430

AIR POLLUTION. WHO WILL MAKE THE DECISIONS. Safety Maintenance, 138(1):19-21,57, July 1969.

The Air Quality Act of 1967 establishes criteria covering the effects of various air pollutants on health and property as well as information on the most effective and economical methods for controlling the sources of specific contaminants in the air. The attainment of specific goals for air pollution standards and control is left to each state and local government using the Federal legislation as criteria. For this reason, public hearings are being scheduled in the coming months in all 50 states for two purposes provided for in the Air Quality Act: (1) to determine the air quality standards that their governing bodies will enforce and (2) to decide on the methods and timing of individual state and local government programs to reach these goals.

7312 APTIC NUMBER 15710

Searle, Victor C.
TECHNICAL INFORMATION RESOURCES IN THE AIR POLLUTION FIELD. J. Air Pollution Control Assoc., 19(3):137-141, March 1969. 3 refs.

In common with other technical fields and disciplines, the air pollution area has "information explosion" problems, compounded by the interdisciplinary nature of the field and the current increased emphasis on air pollution and its control. The development of technical information programs to meet these needs is traced, with emphasis on the Air Pollution Technical Information Center established by the National Air Pollution Control Administration of the Department of Health, Education, and Welfare. The Center is based on a delegation of responsibility by the Office of Science and Technology, Executive Office of the President, and now contains over 12,000 current references, with an acquisition rate of approximately 200 per month. In addition to the U. S. journal literature, particular emphasis is placed on the foreign literature and on U. S. Government research reports. Other programs discussed include the Air Pollution Control Association, Bay Area Air Pollution Control District, Center for Air Environment Studies at Penn State, and centers serving particular industries. Services available from each are described. (Author's Abstract)

7313 APTIC NUMBER 15711

THE CLEAN AIR ACT, 1968. Smokeless Air (London), 39(148):127-130, Winter 1968.

The Clean Air Bill received the Royal Assent on October 25, 1968. To be known with the 1956 Act as the Clean Air Acts, 1956 and 1968, the new Act supplements, extends, and in part repeals the provisions of the 1956 Act. Clauses 2, 6, and 8 to 15 will become

effective on April 1, 1969; the remaining clauses will become effective later as dates yet to be announced. Some of the provisions of the new Act are discussed briefly.

7314 APTIC NUMBER 16330

Stumph, Terry L. and Robert L. Duprey
TRENDS IN AIR POLLUTION CONTROL REGULATIONS. Environ. Control Management, 139(2):45-46, Feb. 1970. 2 refs. (Presented at the 1969 Annual Meeting of the Air Pollution Control Association.)

Existing odor control regulations consist of a variety of partially successful measures. These include nuisance type restrictions based on ambient air detection of odors, process restrictions for certain known odor-producing sources, and control equipment requirements for specific source operations. Most odor regulations are directed at measurement of odors in the ambient air. This approach is justified because human response to ambient odor must be the ultimate criterion of acceptable odorous emissions. St. Louis adopted a regulation that allows a panel of observers to evaluate odor intensity of ambient air samples when such samples are diluted with specified quantities of odor-free air. A similar procedure was proposed by Huey but did not offer a method for abating such odors at the source. Odor control regulations in the form of process restrictions and control equipment specifications were applied to certain known odor-producing operations. Los Angeles, St. Louis, and many other agencies require that effluents from animal matter reduction be incinerated at a temperature of 1200 F for at least 0.3 seconds. Los Angeles County Air Pollution Control District developed a quantitative odor-measurement that can be applied at the source. Odor concentration is expressed in odor units per standard cubic foot of flue gas. Possible developments in control regulations include required elimination of all visible emissions, emission standards for sulfur oxides from fuel combustion, process-weight-rate and potential-emission-rate regulations for specific industry types for particulate and gaseous pollutants, mass-emission-rate standards that require application of modern flyash collectors to incinerators, and emission standards that limit the mass rate of emission of odors measurable by source sampling.

7315 APTIC NUMBER 16286

Task Group on Technological Forecasting in the Federal Government, Washington, D. C.
THE ROLE OF THE FEDERAL GOVERNMENT IN TECHNOLOGICAL FORECASTING. Report to the President's Committee on Manpower and to the National Commission on Technology, Automation and Economic Progress, 258p., Jan. 1966. 78 refs.
CFSTI: PB 170599-2

The findings of a study of the actual and potential use of technological forecasting in the Federal Government, with special attention to its application in the development and use of manpower, are reported. The forecasting of invention, innovation, or diffusion of technology is considered only one component in the more critical forecasting of such factors as occupational demand, employment, or industrial growth. Improved forecasting capability can be useful at the local level, where there is need for complete information on specific job openings, 1 to 5 year forecasts of specific occupational requirements and 1 to 10 year forecasts by broad industrial and occupational categories of regional trends affecting manpower. Long-term (5-20 year) forecasts of manpower requirements are needed but are methodolcgically difficult to compute; greater flexibility in vocational training is more feasible than training based on long-term specific job forecasting. There is also a need for a model of the nation's manpower system, capable of manipulation to show the effects of policy changes 1 to 20 years in the future. At the national level, forecast information is needed to provide national inputs to local programs, as guides to policy deliberations, and as aids in curriculum development. Simultaneous efforts should be made to eliminate the many constraints on the effective use of forecast information: the absence of agencies to use this information; pressures to act on the basis of past and immediate problems rather than future problems; difficulties in interpreting forecasts; the skepticism with which forecasts are usually regarded; and the lack of well-defined objectives for manpower activities against which the usefulness of forecasts can be measured. Topics specifically discussed include manpower adjustment, primary education and training, law and policy affecting manpower, the Federal Government's concern with manpower, technical-economic planning, and methodology. A summary chart giving examples of technological forecasting, with applications, scope, and validity, is included.

7316 APTIC NUMBER 16220

REDUCTION AND LIMITATION OF DUST EMISSIONS IN MIXING PLANTS FOR BITUMINOUS ROAD PAVEMENT MATERIAL. (Verminderung und Begrenzung des Staubauswurfs bei Mischanlagen fuer bituminoese Strassenbaustoffe). Text in German. Wasser, Luft Betrieb, 12(6):369-371, June 1968. 5 refs.

The VDI (Association of German Engineers) Guideline 2283 appeared in print in July 1967. Based on the recommendation of this guideline, the state of North Rhine Westphalia issued the 6th regulation concerning implementation of the law for the maintenance of clean air of Oct. 17, 1967. The guideline recommends that the cleaned waste gas from mixing plants for bituminous road pavement material never exceeds a dust concentration of 150 mg/standard cu m. The stack height shall be determined along the same lines as for sulfur dioxide emissions. The smoke plume must be lighter than No. 2 on the Ringelmann scale. Only for the heating up period may the smoke pluse assume the shade of No. 2 of the Ringelmann chart, but not longer than for 5 minutes. Dust separating systems must be designed to clean gases with a dust content of 150 g/standard cu m. Waste gases may leave only through the stack. All other possible escape routes must be enclosed, and the gases drawn off by exhaust fans. The State of North Rhine Westphalia demands that stacks be at least 12 m high. The noise may not exceed 55 dB during the day and 40 dB during the night.

7317 APTIC NUMBER 15719

Linton, Ron H.
PROTECTING OUR ENVIRONMENT. Arch. Environ. Health, 18(2):235-239, Feb. 1969.

The objectives and findings of the Task Force on Environmental Health and Related Problems are discussed by the chairman of the group. Ten environmental hazards which needed immediate action were identified and the most beneficial approach was determined. A system was devised for developing new action goals in the future. Some recommendations were made for the implementation of the programs.



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7318 APTIC NUMBER 16400

SECOND REPORT OF THE (SWISS) FEDERAL COMMISSION FOR AIR HYGIENE TO THE FEDERAL INTERIOR DEPARTMENT (1962-1967). (Zweiter Bericht der Eidgenoessischen Kommission fuer Lufthygiene zuhanden des Eidgenoessischen Departments des Innern) (1962-1967). Text in German. Bull. Eidgenoess. Gesundheitsamtes, Beilage B, No. 3, 1968. 25 refs.

A survey of the activities of the Swiss Federal Commission for Hygiene, and a list of publications by its members, is followed by a discussion of the sources and the extent of air pollution in Switzerland. Also examined are the dispersion and dilution of pollutants, their effects on plants, animals, and humans, and control technology. In conclusion, existing regulations are reviewed. Domestic heating systems, motor vehicles, and industries are found to be main sources of pollution. In summer, air pollution is negligible in rural areas and in many urban residential areas. In winter, emissions caused by domestic heaters become apparent. On some winter days the SO2 content exceeds 0.3 ccm/cu m. In the vicinity fo some industries, considerable amounts of dust, soot and smoke are accompanied by disagreeable odors. However, no health impairment in humans has yet been reported. Emissions of fluorine compounds have injured plants and animals. Because of demographic and economic developments, it is assumed that the extent of air pollution will increase. Recommended preventive measures include obligatory inspections of heating aggregates, adequate chimneys on each home, regular sweeping of the chimneys, limitation of the sulfur content of fuels for domestic heaters to 0.5%, and centralization of home heating systems. As far as motor vehicles are concerned, highways, when possible, should bypass villages and cities. The flow of traffic in inner city areas should move quickly. Limits must be established for industrial emissions, suitable sites selected for new industrial complexes, and regulations governing domestic heaters standardized.

7319 APTIC NUMBER 13494

Dryden, I. G. C.
CHEMICAL CONSTITUTION AND REACTIONS OF COAL. In: Chemistry of Coal Utilization, Supplementary Volume, H. H. Lowry (ed.), National Academy of Sciences, Washington, D. C., Committee on Chemistry of Coal, p. 232-295, 1963. 392 refs.

Various methods of determining the chemical composition of coal are surveyed. Solvent extraction yields little information about the coal molecule, apart from a molecular weight distribution. If solvent extracts contain more than 1 to 5% of the parent coal, they resemble it closely, provided they are prepared below 250 C. If prepared above this temperature, pyrolysis has clearly modified their composition. The best specific solvents for coal contain a nitrogen atom with a readily available pair of electrons. Evidence from polarography has suggested that certain nuclei containing one, two, and three rings play an important part in coal structure. X-ray histograms suggest that about one-half of the carbon in the nuclei is almost equally distributed between one, two, and three rings, but these estimates may be biased toward the larger ring systems. In the polarography of coal extracts, the frequent occurrence of half-wave potentials, for the reduction of aromatic systems, points to the presence of a considerable proportion of biphenyl, naphthalene, phenanthrene, and triphenylene structures. The extent of reduction suggests a minimum polycyclic aromaticity between 0.35 and 0.5. Methods of functional group analysis and polarography at lower potentials have shown that the hydroxyl and carbonyl group concentrations account for 70 to 90% of the O2 in bituminous coal. Hydrogenation, extensive oxidation, hydrolysis, pyrolysis, and fluorination are the most interesting reactions of coal, but furnish only limited information about the structure of coal itself.

7320 APTIC NUMBER 16251

Haagen-Smit, A. J.
AIR CONSERVATION. Science, 128(3329):869-878, Oct. 17, 1958. 11 refs.

At the present time, air pollution control is concerned with pollutants present in concentrations of a few parts per million; in the future, it will need to consider the removal of pollutants present in quantities smaller by a factor of ten. Effective cleaning procedures will require advances in the field of engineering and in theories of inorganic, physical, physiochemical, and photochemical processes. In addition, solutions will be needed for legal and economic problems, as well as those involving the physiology and pathology of plants and animals. The complexity of air conservation problems is illustrated by smog, which contains ozone concentrations 20-30 times higher than those present in unpolluted air, where the normal amounts are 1-3 pphm. It may take years to unravel relatively simple reactions, such as the photodecomposition of acetone, biacetyl, etc., that contribute to ozone formation. In the air, these reactions are complicated by the presence of oxygen, water, carbon dioxide, and other compounds from the evaporation of gasoline and the burning of trash. The application of new methods of calculating pollution distribution and movement would permit determination of the future development of smog at different locations and a comparative analysis of the effects of removing different pollutant sources. To establish valid pollution levels, more epidemiological studies must be undertaken.

7321 APTIC NUMBER 15930

POLLUTION PROCESSES IN ECOSYSTEMS: APPENDIX 1 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-Natural Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 31-614, 1966.

Residue disposal problems are discussed with special attention given to the elimination of pollutants that affect one or more species in the biosphere. Even when these pollutants are present in small concentrations and have no direct effects on organisms, they can upset the balance between natural environmental forces and the biota. If uncontrolled, they could lead to climatic



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changes affecting world precipitation patterns. Many practical problems in the residue-disposal field now are attacked without full use of available knowledge. Short-range remedies have prevailed over long-term solutions; local aspects over regional or basin-wide planning. Set standards have met single objectives but failed for others. There must be clear recognition that at times multiple uses of land, water, or air resources can have incompatible aims. Decisions may occasionally be possible on the basis of strict cost-benefit analysis, but in many instances issues of health, conservation, and recreation will dictate solutions. Active research in single environmental disciplines must be correlated in a single framework related to the ecology of man. Among the requisites for a long-term solution are the preparation of complete maps of the geographical distributions of biotic systems, stimulation of research on river systems to establish their capacity for regeneration with limited refuse discharge, stimulation of technological developments on closed systems, using mechanical as well as biological approaches for reduction of residue loads; establishment of recording sites for monitoring the elements of the hydrological cycle in both disturbed and undisturbed environments; and establishment of a clearing-house of knowledge on environmental changes caused by man-made residues.

7322 APTIC NUMBER 15932

THE RESIDUE SITUATION-CURRENT AND FUTURE. APPENDIX 4 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 126-180, 1966.

The nature, extent, and effects of environmental pollution are examined as they exist today and as they can be projected for the future. In addition, leglislative and other institutional characteristics of control mechanisms are described, and current and future technological capabilities of dealing with pollution problems assessed. Restraints imposed by either society or technology on an improved capability to manage residues are identified. To encourage technological innovation, it is recommended that federal and state governments supply risk capital to build 'first-generation' plants of new concept and design for waste management processes in the expectation that unsubsidized 'second-generation' plants will follow. A logical means of accomplishing this is demonstration grants, providing two-thirds to three-quarters of the cost to build and operate initial facilities for disposing of or transforming wastes. Another means is subsidization of municipalities or industrial organizations will to try new concepts and designs that builders would not otherwise attempt. The grant program should be on a scale large enough to support the construction and interim operation of several full-scale plants each year for a number of years in each aspect of the environment: air, land, and water.

7323 APTIC NUMBER 15931

THE TRANSPORT SYSTEM. APPENDIX 3 TO WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 95-125, 1966.

The over-all system within which man operates is examined, and the natural or artificial systems involved in utilizing sequestering environmental residues, or wastes, are described. In a natural environment, pollution loading in the atmosphere is reduced by the transformation of pollutants into other materials, the aggregation of particles to sizes at which gravity removes them from the air, the incorporation of gases and small particles in cloud droplets, and the subsequent rainfall deposit of these materials and larger particles. When filtered by trees and vegetation, these pollutants are spread over vast areas. In contrast to natural pollution sources, man-made sources are localized and increasingly by concentrated in small areas. In addition to this known local overburdening of the air, there is the possibility of exceeding the global removal capacity of the atmosphere and resulting deleterious change in the geo-climate. The only sinks capable of accepting the whole range of man's solid wastes are the land and ocean. Consequently, engineering systems for disposing of solid wastes must be directed to dispersing waste so widely that it is incapable of serious local effects, collecting wastes in heavy concentrations and sealing it under vegetation or beneath ocean waters, or recycling to transform waste into new products. Similarly, the organic fraction of domestic and industrial wastes should be composited rather than incinerated.

7324 APTIC NUMBER 15928

WASTE MANAGEMENT AND CONTROL: A REPORT TO THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY. National Academy of Sciences-National Research Council, Washington, D. C., Committee on Pollution. Pub. 1400, p. 3-27, 1966.

In setting acceptable pollution levels, consideration must be given to the capacity of the environment to assimilate residues; this varies widely with the geology, geography, hydrology, and meteorology of localites. For example, meterological data show that Appalachia is one of the most pollution-prone areas in the county; if it is to be industrialized, activities should be restricted to those that will not produce excessive wastes. In cities, where the massive producers of pollution are concentrated, ways must be developed for collecting, separating, and concentrating residues at the source if the ecology of shore and lake waters are to be preserved. Ideally, all water would be purified and reused and all solid wastes returned as raw materials. In practise, however, there will always be some unusable residues. Instead of being dispersed, they should be concentrated in residue mountains or caves, particularly if they are potential natural resources like discarded iron. To develop the technology necessary to transform and store residues, a full-scale experiment residue-control system must be planned, designed, and constructed in a new city. This system would embody the newest and best principles of recycling, reusing, and recovering residues, and serve as a demonstration model. The development of this technology will require federal initiative and support providing cost data and performance and design criteria.

7325 APTIC NUMBER 16183

Oba, Hideki
JAPANESE INDUSTRIAL POLLUTION PROBLEM FROM HISTORICAL VIEW POINT. (Nihon no kagakugijutsushi kara mita sangyokogai no shomodai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(1):11-17, Jan. 15, 1969. 13 refs.

Some aspects of industrial pollution in Japan during the decades between World War I and World War II are discussed, including episodes which drew wide public attention. The administrative approach toward pollution control in that period is explained. Historically, air pollution problems have come to public attention as a consequence of industrialization. For instance, eighty-six years ago the demand for coal as an energy source was about 140,000 tons; six years later it had increased to 270,000 tons, and nine years later to 384,000 tons. The problem of smokestack emissions was first recognized in Osaka, which issued the first regulation on smoke dust, and prohibited the construction of plants burning cokes or coals. In a corresponding development, research activities were encouraged. Carbon monoxide and sulfur dioxide emissions were first discussed at the General Meeting of City Problems Conference. At the same meeting the results of automobile exhaust measurements were reported. Also discussed were the following methods of controlling atmospheric pollutants: the redesign of incinerators to achieve complete combustion, the use of smokeless fuel, and improvements in fuel burning. It was pointed out that problems of wastes disposal and waste water from pulp manufacturing factories were understood as early as the 1800's.

7326 APTIC NUMBER 16523

Urrutia, D. Jose Llado Fernandez
ASPECTS OF INDUSTRIAL CONTAMINATION. (Aspectos de la contaminacion industrial). Text in Spanish. Rev. San. Hig. (Spain), 43(9-10): 663-713, Sept.-Oct. 1969. (Pages 691-710 are pertinent to air pollution.) (Presented at the Conference of the Sociedad de Higiene y Medicina Social, April 16, 1969.)

The industrialization processes, the increase in industrial water and air pollution, the causes of contamination, and Spanish legislation for the control of air and water pollution are discussed. The principal atmospheric contaminants are carbon oxides, sulfur oxides, nitrogen oxides, hydrocarbons, and particulates. The amounts were estimated and it was found that half of the pollutants are concentrated in the major cities. The main sources of pollutants are automobiles, heaters, incinerators, and industrial processes. Industrial emissions are not controlled because of poor equipment, insufficient finances, and inefficient legislation. Another important source is radioactive contamination from laboratories, hospitals, and nuclear centers. The irritant effects of pollutants on the eyes, nose, and throat were briefly discussed. Foreign legislation was also briefly discussed. Generally, foreign regulations prohibit the emission of gases and smoke above certain pre-established limits, provide vehicle emission standards and regulation of some control equipment. Spanish legislation is scarce and inefficient. Old regulations include provision for industries to emit noxious gases with the consent of Sanitation inspectors and weekly atmospheric analyses for chemicals and bacteria. Other old regulations prohibit the establishment of vapor-producing industries within 500 m of a town and a maximum emission limit for sulfur anyhydrides at 8 g/cu m. More recent legislation established maximum allowable concentrations for smoke, particulates, sulfur anhydrides, and carbon anhydrides, and an opacity index. The amounts of sulfur allowed in combustible liquids for industrial use were prescribed. Carbon monoxide emissions from vehicles and dust emissions from cement industries were also regulated. It was concluded that public and industrial responsibility and enthusiasm for control should be encouraging and more flexible, realistic legislation should be passed.

7327 APTIC NUMBER 13591

Vogely, William A. and Warren E. Morrison
PATTERN OF ENERGY CONSUMPTION IN THE UNITED STATES 1947 TO 1965 AND 1980 PROJECTES. Preprint, World Power Conf., Tokyo (Japan), p. 428-451, 1966. (Presented at the Tokyo Sectional Meeting, Tokyo, Oct. 16-20, 1966, Paper 83.)

The energy needs of the U. S. are met for the most part from domestic sources of petroleum, natural gas, coal, and hydroelectric power. Based on preliminary data for 1965, the total national consumption of energy was equivalent to 13,639 trillion kilogram calories, almost 2/3 greater than consumption in 1947. For the next 15 years it is anticipated that increasing quantities of energy will be needed for the expanded economy. Total consumption of energy in 1980 is expected to be 22,196 trillion kilogram calories, or 63% greater than in 1965. Coal consumption in 1980 is projected at 677 million metric tons, natural gas at 969 billion cubic meters, and petroleum products at 809 million metric tons. Net generation of utility electricity is projected at 2,739 billion kilowatt hours. It is anticipated that 71% of the utility electricity generated in 1980 will come from fuel-burning plants, 12% from hydropower plants, and 17% from nuclear power plants. Petroleum will remain the main energy source for transportation through 1980, with resource inputs exceeding the 1965 level by 69%. In household, commercial, and industrial sectors, combined inputs of direct fuels and utility electricity are projected to exceed 1965 levels by 71% and 50% respectively. Natural gas will remain the ranking energy resource within these sectors throughout the forecast period. (Authors' summary modified)

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